bart
impact
program

IMPACTS OF BART ON THE SOCIAL ENVIRONMENT INTERIM SERVICE FINDINGS

The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART).

The program is being conducted by the Metropolitan Transportation Commission, a nine-county regional agency established by state law in 1970.

The program is financed by the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, and the California Department of Transportation. Management of the Federally-funded portion of the program is vested in the U.S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas, and economic sectors will be measured and analyzed. The benefits of BART, and their distribution, will be weighed against the negative impacts and costs of the system in an objective evaluation of the contribution that the rapid transit investment makes toward meeting the needs and objectives of this metropolitan area and all of its people.

DOCUMENT NO. TM 19-4-76

DOT-OS-30176

BART IMPACT PROGRAM

IMPACTS OF BART ON THE SOCIAL ENVIRONMENT
INTERIM SERVICE FINDINGS

MARCH 1976

TECHNICAL MEMORANDUM

DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VIRGINIA 22151

PREPARED FOR
U. S. DEPARTMENT OF TRANSPORTATION

AND
U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

BIBLIOGRAPHIC DATA SHEET	1. Report No. TM 19-4-76	2.	3. Recipient's Accession No.

4. Title and Subtitle

Impacts of BART on the Social Environment
Interim Service Findings

5. Report Date: March 1976

6.

7. Author(s)

Gruen Associates & DeLeuw, Cather & Co.

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Metropolitan Transportation Commission
Hotel Claremont
Berkeley, California

10. Project/Task/Work Unit No.: Task Order #4

11. Contract/Grant No.: DOT-OS-30176

12. Sponsoring Organization Name and Address

U.S. Dept. of Transportation
U.S. Dept. of Housing & Urban Development

13. Type of Report & Period Covered: Tech. Memorandum

14.

15. Supplementary Notes

16. Abstracts

The Environment Project's definition of the term "social environment" is a narrow one, based on the study's concern with the effects of BART as a physical entity. In this context, the impacts of interest are primarily those which influence the interactions of people in the vicinity of BART. The effects of BART's facilities on privacy are also included. Four impact categories were used to organize this assessment: barriers, safety (against bodily harm), security (against threats to persons or property), visual exposure. The effort included the gathering of complementary types of data, widespread interviews with BART and community officials, consultations with knowledgeable professionals, and direct observation in specific locations.

17. Key Words and Document Analysis. 17a. Descriptors

Bay Area Rapid Transit System (BART)
BART Impact Program
Environmental Impacts
Barriers
Safety
Security
Visual Exposure

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Document is available to the public through the National Technical Information Service, Springfield VA 22151	UNCLASSIFIED	
	20. Security Class (This Page) UNCLASSIFIED	22. Price

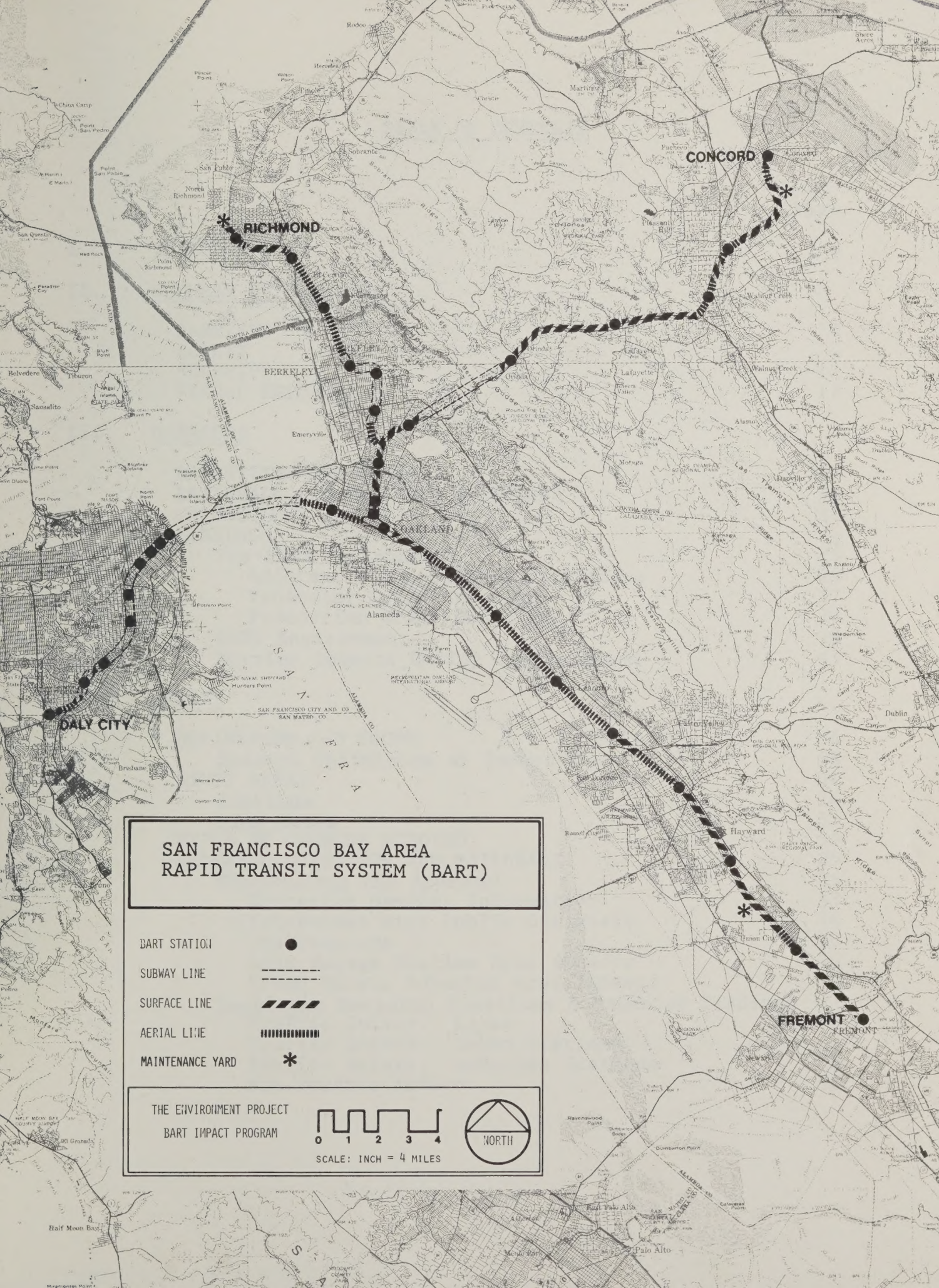

CONCORD
RICHMOND
BERKELEY
OAKLAND
Alameda
DALY CITY
FREMONT
Hayward
SAN FRANCISCO BAY AREA
RAPID TRANSIT SYSTEM (BART)
BART STATION
SUBWAY LINE
SURFACE LINE
AERIAL LINE
MAINTENANCE YARD
THE ENVIRONMENT PROJECT
BART IMPACT PROGRAM
0 1 2 3 4
SCALE: INCH = 4 MILES
NORTH

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

The Environment Project's definition of the term "social environment" is a narrow one, based on the study's concern with the effects of BART as a physical entity. In this context the impacts of interest are primarily those which influence the interactions of people in the vicinity of BART. The effects of BART's facilities on privacy are also included. Four impact categories were used to organize this assessment:

- Barriers
- Safety (against accidental bodily harm)
- Security (against threats to persons or property)
- Visual Exposure

The effort included the gathering of complementary types of data, widespread interviews with BART and community officials, consultations with knowledgeable professionals, and direct observation in specific locations. Wherever "hidden" impacts seemed plausible (i.e., unobservable responses to intrusion of privacy, for example), further exploration was left for Phase II study.

II. SUMMARY OF FINDINGS

BARRIERS

The overall objective of the barrier analysis was to assess, on a systemwide basis, the effects of BART facilities on the ease or hindrance of pedestrian and vehicular movement in areas adjacent to BART lines and stations. This effect of BART as a potential source of barriers extends beyond the actions of BART itself to public improvements taken by adjoining communities in direct response to BART's construction.

The movement patterns of concern are those which cross or run immediately parallel to BART's alignment, and barriers were defined as any physical impediment to these movements by pedestrians or vehicles. To the extent possible, the study was directed at assessing effects of the difference in movement between BART and as it would have been had BART not been built (pp.25-28).

Methodology

Comparison of 1965 aerial photographs (prior to BART construction) with those of 1972 (after the system was built) in the system corridor, and discussions with BART representatives provided a systemwide catalog of changes in movement. Field observations, and discussions with local traffic officials and BART representatives provided the qualitative information needed to arrive at conclusions about the movement changes. Topics considered in the barrier study are:

- Alignment
- Configuration
- Easements to Movement
- Non-Movement Effects

A fifth possible topic, that of BART construction's effects on movement, was not a part of this project.[1]

---

[1]During BART construction the downtown areas of San Francisco, Oakland and Berkeley were the scenes of extensive activity to put BART in subway beneath main streets. These construction activities resulted in numerous detours and obstructions to motorists and pedestrians which ranged in duration from about two years in Berkeley to more than seven years in San Francisco.

Issues and Findings

What is the relationship between BART alignment, configuration, and previous transportation facilities acting as barriers?

About 85% of BART's alignment parallels prior transportation corridors. This situation, even before BART, resulted in barrier effects and subsequent local adaptations (Figure 2.1). The type of adjacent transportation has had an important effect on the intensity of cross traffic along BART's alignment. About one-third of BART's total alignment has intense cross movements, where it is adjacent to arterials and lightly used railroads, while one-half has infrequent cross movement, where it is adjacent to freeways and heavily used railroads. (Table 2.1)

TABLE 2.1
ADJACENT TRANSPORTATION FACILITIES AND
CROSSING FREQUENCY (Prior to BART)

		ADJACENT TRANSPORTATION RIGHTS-OF-WAY					
		Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
BART	Miles	14.1	21.6*	5.2	18.3	11.8	71
	Crossings	43	47	32	154	15	291
	Crossings Per Mile	3.0	2.2	6.2	8.4	1.3	4.1
	Miles	35.7		23.5		11.8	71
	% of 71 Mi.	50%		33%		17%	100%

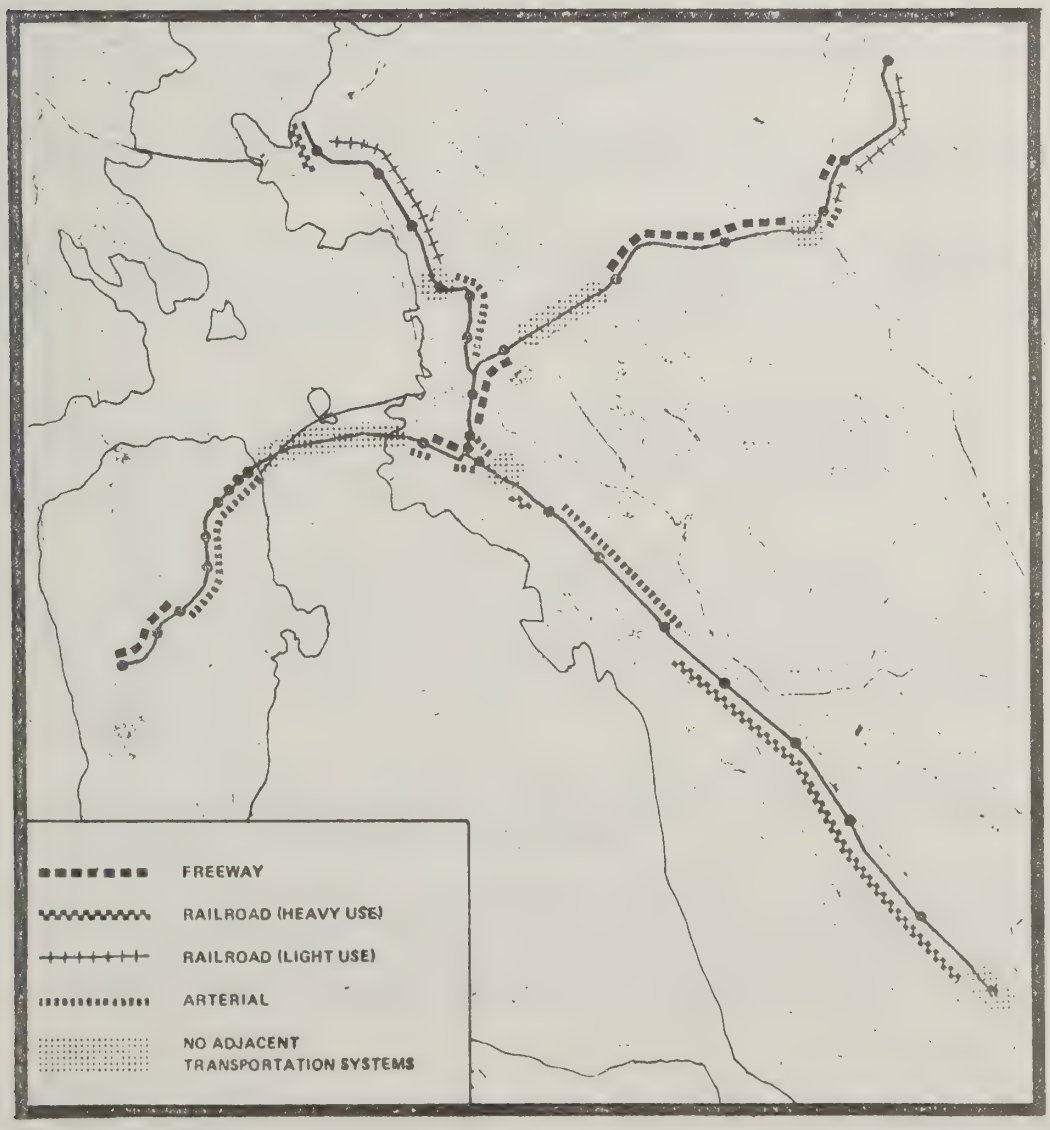
* This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

Of major importance is the fact that BART used three types of configurations in a way which created minimum barrier impact. BART subway configuration is used primarily in areas with parallel arterial alignments and is associated with heavy cross traffic. BART surface configuration is used predominantly in areas where previous strong barriers (free-

FIGURE 2.1
ADJACENT TRANSPORTATION & THE BART CONFIGURATION

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterial	No Prior Adjacent Transp.	Total
Subway Miles	1.3	--	.2	9.4	9.4	20.3
Surface Miles	9.9	14.8	1.0	--	1.4	27.1
Aerial Miles	2.9	6.8	4.0	8.9	1.0	23.6
Total	14.1	21.6*	5.2	18.3	11.8	71.0

* This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.



ways and heavily used railroads) exist. BART aerial structures are used in areas of extensive surrounding movement patterns, along both arterials and railroads.

Because of this, only twelve of the almost 300 streets crossing the BART alignment were blocked and these changes were generally requested or unopposed by local communities. None involved major traffic streets. In addition, all major pedestrian paths were replaced with grade separations.

What improvements in access and ease of movement have been created by BART?

Grade separations and parallel traffic improvements have resulted from BART's construction and in some locations new roadways have provided access where this was previously not possible. (See Appendix A-2 for details).

- Parallel railroads and major traffic streets along with BART have been grade separated from cross traffic.

- Pedestrian bridges have been constructed in residential areas and near schools. Station mezzanines provide weather-protected, traffic-free access across and along some main streets.

- A seven mile major freeway segment was widened and improved in conjunction with BART construction. Several arterials were widened and improved with medians to accommodate BART aerial structures.

- In addition, three major urban boulevards were refurbished and traffic improvements made: Market Street in San Francisco, Shattuck Avenue in Berkeley, and Broadway in Oakland. Over five miles of new or improved frontage road have been provided where BART surface line is adjacent to heavy use railroad.

What effects, if any, has the existence of the Transbay Tube had on maritime activity on the Bay?

According to the Coast Guard Vessel Traffic System[2], the BART Transbay Tube has had no effect on maritime activity on the Bay and even during construction, when barges and rigs were present on the Bay, ships were easily rerouted around them.

[2]The maritime traffic authority on San Francisco Bay.

Were there any notable non-movement effects resulting from BART barrier creation?

In Concord the BART line is on an earth embankment which physically and visually separates a residential area from an industrial area. After seeing the positive effect BART had in separating these two incompatible land uses, the community decided to drop plans to request BART to provide additional overpasses.

In Union City, a similar effect has been achieved. An earth embankment and the Union City station have partially separated heavy industrial facilities from a new residential area.

SAFETY

The analysis of BART's impact on safety focused on changes in the occurrence of traffic and non-traffic accidents as well as accident potential attributable to BART in areas adjacent to BART stations and along its lines. These areas included BART station parking lots, but excluded areas inside stations and on BART trains. Accident potential was defined as the presence, to varying degrees, of factors which contribute to the cause of accidents, i.e., the likelihood that accidents may occur. The factors were identified by interviews with traffic engineers and study of standard traffic engineering references.

Methodology

This investigation was built upon several different types of data, including accident statistics and reports from BART and local jurisdictions, interviews with BART and community police, public officials and patrolmen throughout the system, traffic volume data, census data, and direct observation. The study approach focused on a comprehensive assessment including preliminary interviews on a broad scale, subsequent selection of representative sites for more detailed interviews and collection of other data. Systemwide estimates of impacts and their major determinants were derived from these studies. Where available data allowedand when applicable in specific situations, statisticalcomparisons were made to determine the significance of findings (p. 39). Some methodological discussion is included underissues and findings where applicable to specific topics.

The issues and findings are presented here for traffic safety (by general location and type) and specific non-traffic safety impacts.

Issues and Findings

Have traffic accidents or accident potential changed significantly and been attributed to BART?

(a) Along BART lines?

(b) In downtown stations?

(c) In suburban stations specifically with relation to:

- Parked cars on nearby streets?
- Moving vehicles on nearby streets?
- Pedestrian and vehicle movement in BART parking lots?

(a) Traffic Safety: Along BART Lines

One might expect that necessary street closures and rerouting resulting from BART operations and facilities could have caused many negative changes or, conversely, the placement of BART lines might have provided many opportunities to improve previously unsafe traffic conditions. However, neither seems to be the case.

The few significant BART-related improvements in line area safety were found to be:

- Downtown street improvements in San Francisco, Oakland and Berkeley which were largely BART-induced[3] include widening of streets and installation of better signalization and outdoor lighting equipment. These have resulted in easing of pedestrian and vehicle flow and parking improvements.

- Vehicular grade separations where roads previously intersected railroads have been constructed in the Richmond, Concord and Hayward areas, resulting in a decrease in actual conflict between systems.

- BART's construction of a pedestrian bridge over its tracks and an arterial street at the eastern portal of the Transbay Tube where pedestrians crossed in heavy traffic, resulted in a decrease in actual conflict between vehicles and pedestrians.

---

[3]Although BART provided the original impetus, actual sponsors of those improvements were local merchant associations, the municipalities involved, and the U.S. Department of Housing and Urban Development.

Although not a part of this study, safety during BART construction was considered briefly. Construction, particularly cut and cover for portions of subway lines in urban areas, was considered by those interviewed in the pre-BART survey[4] to have reduced safety. Construction effects most often cited included creation of "dangerous areas" near BART. However, no further details could be discerned from survey data, and no statistics on BART construction accidents were found. Observations of current BART-related construction areas in San Francisco revealed that (a) often traffic regulations are unclear, if present at all, and (b) the allowed directions of traffic flow and regulations change frequently (p.43).

(b) Traffic Safety: Urban Stations

In general, actual accidents and accident potential have not changed or been attributed to BART-induced traffic within the areas adjacent to station entrances and exits. However, pedestrian travel patterns, particularly those of BART commuters from the East Bay to downtown San Francisco, were somewhat changed due to BART's station locations relative to bus terminals and auto parking lots. BART station mezzanines, street improvements and generally minor BART-related changes in downtown station area bus traffic appear to have helped maintain the same level of safety, despite increased concentrations of pedestrian movement (Downtown BART stations exit anywhere from 2,000 to 14,000 patrons during AM peak periods; (pp.44-45).

There is a minor exception at the Berkeley center city station. Pedestrians are required to cross a high volume street to gain access to bus service (University of California Humphrey Go-BART Shuttle Bus) resulting in increased violation of pedestrian traffic regulations and an increase in accident potential.

(c) Traffic Safety: Suburban Stations

- Parked Autos on Streets Near BART

In general, there is little on-street parking by BART patrons. Two of the 25 non-downtown stations, Glen Park and Balboa Park, have no parking facilities. Both of these have significant on-street parking volumes. Of the 23 BART stations with parking lots, only two have substantial overflow -- Daly City and Fremont. (Table 2.2) Seven other station parking lots are at capacity and have overflow on-street parking.

[4]Pre-BART Data Analysis, Environmental Project Technical Memorandum (Draft), March, 1975.

TABLE 2.2
BART STATIONS WITH OVERFLOW PARKING (as of January, 1975)

Station	Parking Lot Capacity	Overflow
Daly City	820	1,000
Fremont	700	550
Glen Park	0	350
Union City	477	350
Balboa Park	0	300
Walnut Creek	1,114	150
Lafayette	650	150
Concord	1,059	100
Pleasant Hill	1,337	100

Significant BART-related increases in accidents involving parked cars were found only near the Daly City station. In the Daly City station area, parked auto and increased traffic volumes due to BART were very high on several two-lane residential streets. This station is the terminus of a line originally planned to extend much farther into San Mateo County. That county did not vote to join the BART district. However, many San Mateo commuters drive to Daly City and ride BART to downtown San Francisco.

A comparison was made between stations considered by local officials and traffic engineers to have appreciable accident potential and those that did not (pp.48-52). The differences in conditions for stations with accident potential are characterized by:

- Adjacent two-lane residential streets,
- Presently no or few available parking lot spaces,
- A propensity for future local population growth or development,
- No known plans for lot expansion or increased feeder bus service,
- Locations on the Richmond line which will soon have direct transbay service.

All or most of these conditions are present in ten stations:

Ashby	Concord
North Berkeley	Balboa Park
El Cerrito Plaza	Fremont
El Cerrito del Norte	Bayfair
Richmond	Pleasant Hill

- Moving Vehicles on Streets Near BART

Significant increases in moving vehicle conflicts[5] have occurred and been attributed to BART in some medium or low density station areas. These areas are those where traffic volumes related to BART have increased near principal station exits or entrances and where traffic controls either are not present or fail to operate effectively under the increased traffic volumes (pp 52 - 66). Table 2.3 indicates the major causes of increased accidents around these stations.

TABLE 2.3
INCREASED MOVING VEHICLE ACCIDENTS AROUND BART STATIONS

Station	Cause of Accident
Daly City	-- High volume of autos and pedestrians. -- Pedestrian-auto conflict at station entrance. -- Lane changes and complex intersections.
El Cerrito del Norte	-- Changed patterns of vehicular movement. -- Inadequate signalization.
San Leandro, Hayward, Union City, Fremont	-- High volume of buses, autos and pedestrians. -- Inadequate signalization. -- Pedestrian-auto conflict at station entrance/exit.

[5]Conflicts can be defined as movement patterns which could result in accidents although not necessarily doing so.

In addition, there is high mixing of pedestrian and vehicle movement in some parking lots:

- Bus versus other mode conflict potential (Walnut Creek, San Leandro)
- Pedestrian versus auto conflict potential (Fruitvale, Pleasant Hill, Daly City)
- Buses double parking and creating movement hazard (Bayfair and Fremont)

Has BART had any significant effects on non-traffic safety in line or station areas?

The greatest potential danger of non-traffic safety due to BART is trespassing because of the exposed 1000 volt third rail. In 1973, sixteen locations were identified by a BART-commissioned independent survey[6] as allowing easy unauthorized access to BART facilities and trackway. Most of the report recommendations have not been implemented except for the suggestion to build a previously planned pedestrian overpass to eliminate trackway trespassing in Richmond.

Despite the potential danger, BART police spokesmen stated that trespassing has not been a significant problem. The only traces of trespassing that have been found repeatedly have been cut fences in the Hayward and Richmond areas, apparently by juveniles seeking "short cuts" across the BART right-of-way. The Richmond problem was eliminated by the already mentioned overpass.

Since the start of BART operations there have been only three accidents involving the public on trackways, two of which were apparent suicides. All occurred at station platforms rather than along the right-of-way. During 1974 transbay service only five trackway trespassing incidents were recorded, four of which were at stations. There were no resultant injuries.

SECURITY

The investigation of BART's impacts on security focused on changes in crime and crime-related activities attributable to BART. Neighborhoods and other areas adjacent to BART stations, BART parking lots, and along the BART lines were included in this study. Areas inside BART stations and on trains will be

---

[6]Arthur Young & Company, "Final Project Report and Analysis of Police Services Division" prepared for BART (September 1973).

studied in a separate task in Phase II. BART impacts were defined as appreciable[7] differences in crime or crime-related activity between what has occurred with BART and what was assumed would have occurred in the same locations and during the same period without BART (p.82).

Issues and their respective findings are presented according to three major location types: areas along BART lines, downtown station areas, and all other station areas. Together these provide comprehensive coverage of the BART system's major relevant facilities.

Methodology

The study approach for this phase utilized a variety of data sources and types. Initial rounds of interviews with city police and others were conducted throughout the BART system, followed by more detailed interviews with selected officials. Interviews with BART and local police officials allowed information to be gathered concerning the overall crime situation as well as police policy. Interviews with station agents and patrolmen provided valuable input about day-to-day criminal activity near BART lines and stations. Direct observations by trained staff and secondary data collection (from BART as well as local jurisdictions) were also employed for a number of specific locations. The data collection process was complicated by unwieldy classifications of crime statistics and the inconsistency of the grouping of these statistics over time. Consequently, this information was synthesized from the various data sources as well as specific site studies to yield findings on the nature, extent and location of BART-related crime (pp.80-81).

Issues and Findings

BART Lines

Has crime or crime-related activity increased appreciably on or near BART lines in center city or suburban areas?

Typical BART line areas such as those under the 24 miles of aerial structures and many line overpasses do not appear to be used as hiding places for criminals, escape routes or focal points of increased criminal activity. An analysis of BART statistics on incidence of reported crime since the

[7]When more than one independent informed source yielded credible evidence that a change or difference was regarded as meaningful in the local context, it was regarded as appreciable.

commencement of transbay service (September through December 1974) showed only a total of 14 trackway (not including station areas) crimes. Virtually all of the incidents were minor crimes such as vandalism; none were crimes against persons. In addition, local police reported no problems in these areas.

BART's linear parks constitute a special case. The El Cerrito and Albany linear parks include walkways with extensive landscaping on a 2.7-mile long narrow right-of-way beneath an aerial portion of the trackway. In Concord, a 1/2-mile section of aerial line on a wider but minimally improved right-of-way can also be termed a linear park, although less formally. Crime in the linear parks and adjacent neighborhoods has not increased disproportionately to crime in other nearby locations (pp. 84 - 86). The only exception to this has been infrequent vandalism of lights, trees and park furniture, all of which are typical of city parks in general.[8]

Despite this low incidence of crime, some elderly citizens in the El Cerrito area have complained to the police department about park security and view the linear parks as being unsafe. Direct observation, particularly in the Albany and El Cerrito linear parks, showed these concerns to be understandable. Randomly placed low to moderate lighting, as well as landscaping and frequent aerial structure pillars create shadows which could provide concealment for criminals. In the El Cerrito park some parkway areas divide city blocks and these are not visible or easily accessible from local streets.

Central City Station Areas

Has crime increased appreciably in urban BART station areas and been attributed to BART?

Stations designated "urban" are those nine (one not yet operating) in downtown San Francisco, Oakland, and Berkeley, as well as San Francisco's Mission district. All are subway stations in areas basically downtown and commercial in character, although in a few cases there are substantial residential populations very near. No parking lots are provided here by BART, but street and pedestrian traffic is typically heavy. Most of the stations include small outdoor plazas, generally at street level.

According to police officials, local patrolmen, and analysis of BART crime reports, there have been few crime problems in these station plaza areas. The only criminal activities

[8]According to local police officials in the vicinities of the linear parks.

identified by BART police officials[9] or station agents were infrequent purse snatchings and vandalism. BART data indicated only 12 crimes in these areas during September through December 1974, two of which were directed against persons. However, the Powell/Market plaza, which is below street level, has several potential hiding places created by shadow, low lighting in a pedestrian underpass and hidden corners. Notably, despite very intense pedestrian activity in the area, this particular plaza is generally not heavily used even though other plaza areas are fairly active.

Loitering in plaza areas, although occurring in all station plazas, is regarded as a nuisance by police officials[10] only at the Powell/Market station. Direct observation, as well as interviews with station agents, indicates that loitering neither deters patrons from using BART nor impedes pedestrian movement.

All Other Station Areas

What changes in crime or related activities have occurred in non-downtown station areas and been attributed to BART?

Of the 25 BART stations in non-downtown areas, 23 have parking lots. Most are in residential or mixed residential/commercial areas. Although in general the incidence of crime in the neighborhoods near these stations has evidently not been affected by BART, the reported incidence of parking lot crime is substantial. During September through December 1974, a total of over 600 crime reports were filed for such areas by BART police. Only 10 of these, however, were directed against persons; most were property crimes, while some involved narcotics or other miscellaneous offenses. (Table 2.4) The three most frequent types of crime were found to be auto-related crimes (auto theft and burglary), petty theft, and vandalism. These occurred in all the lots to some degree. It was found that these parking lots were generally unattended or infrequently patrolled, largely inactive at midday, and out of view of station agents due to station design.

---

[9]BART has an 80-person police force which patrols the system 24 hours a day. Although only a limited level of coverage is possible, all BART facilities including trains, stations, parking lots, lines and maintenance yards are patrolled.

[10]Police officials view the potential for crime as being higher when many idle persons congregate in an area than when there are fewer people and more constant movement.

Auto-related crimes appear to be the most frequent types of crime in BART parking lots. These are also the only types of potentially BART-related crime found to be increasing appreciably in neighborhoods adjacent to stations. According to BART crime reports, 21 out of 23 stations with parking lots had auto thefts or auto burglaries during 1974 transbay service. One station, Coliseum, had approximately one-third more reported auto-related crimes during this period (21 reported incidents) than did any other station.[11] However, the Coliseum area, one of low income, had an exceptionally high crime rate among the station areas even before BART existed.

TABLE 2.4
REPORTED PARKING LOT/PLAZA CRIME (September - December 1974)

	PARKING LOTS				PLAZAS	
	Concord Line (6 Stations)	Richmond Line (6 Stations)	Fremont Line (9 Stations)	Daly City Line (2 Stations)	Daly City Line (2 Stations)	TOTAL
PERSON CRIMES						
Assault/Battery	0	1	0	1	0	2
Strong Arm Robbery	0	2	2	0	0	4
Purse Snatching	0	0	4	0	0	4
PROPERTY CRIMES						
Auto Theft, Auto Burglary	48	42	70	8	0	168
Petty Theft	43	62	77	8	1	191
Vandalism	27	26	35	3	1	92
MISCELLANEOUS						
Sex Offenses*	1	0	5	0	0	6
Narcotics	1	1	9	0	0	11
Disorderly Conduct	3	1	2	1	0	7
Suspicious Persons	9	11	14	2	0	36
Other**	20	15	40	21	1	97
TOTAL	152	151	258	44	3	

*No rapes were reported

**Minor crimes and miscellaneous reports

Where auto theft and burglary increases in neighborhoods adjacent to stations have been observed and reported, there are the highest number of on-the-street BART patron autos (Fremont and Daly City). These stations have parking lot capacities of 700 and 820, respectively. In the Daly City area, more than twice the number of BART patron-parked autos (over 1000) were

[11]A 1500-car two-level parking garage (BART's first) is now under construction at this station to alleviate the problem.

found on the streets than at any other station. The approximately 500 BART patron autos parked on streets near the Fremont station are parked in an open space and commercial area with a low level of surveillance.

Interestingly, no appreciable increases in auto-related crimes have occurred on streets near the two non-downtown stations in San Francisco without parking lots (Glen Park and Balboa Park), even though both are sites of substantial BART on-street parking.

Petty theft (mainly theft of auto parts, bicycles and bicycle parts) and vandalism have increased appreciably in some areas but have tended to be confined to BART parking lots. There have been about the same number of petty theft incidents as auto-related crimes (168 versus 181). Where petty theft increased most (10 or more incidents), it occurred at stations located in low or middle to low income areas.[12] Although vandalism is the third most frequently reported crime, its incidence was considerably less; no station reported more than 10 incidents, and all but four stations experienced some.

Generally, BART has had little or no effect on other property crimes, or on person-to-person crimes in parking lots and neighborhoods adjacent to stations. There is one exception: several persons have been accosted in a pedestrian underpass at the Coliseum station. The underpass is a covered tunnel-like structure with hiding places, shadows, and little or no surveillance. In addition, it is located in a high crime, low income area.

Some suburban police officials also voiced expectations that urbanites would use BART as a vehicle for criminal activities in suburban station areas, but there has been no recorded evidence of this having occurred to date.

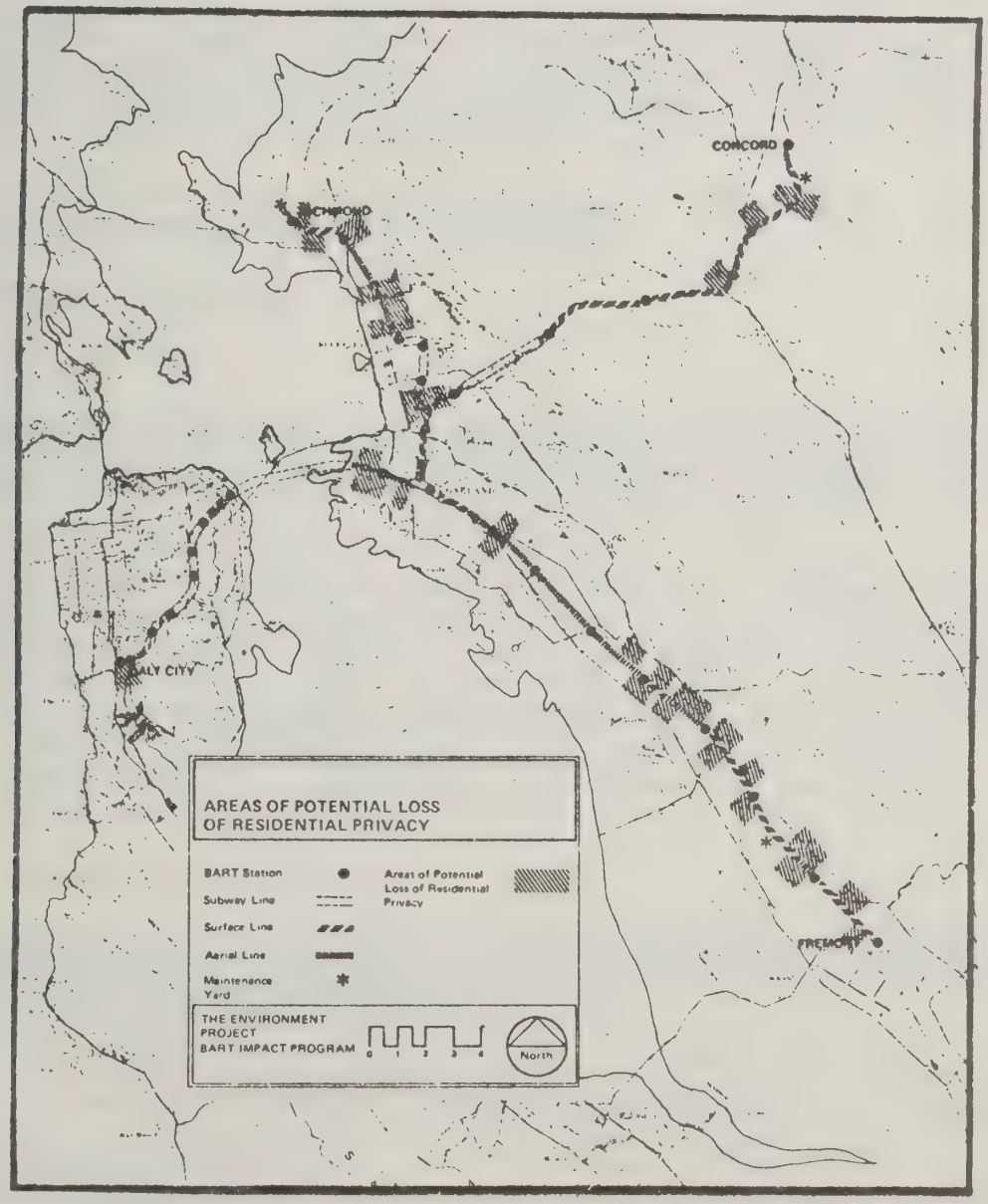
VISUAL EXPOSURE

The visual exposure study was undertaken to determine the extent of certain effects when BART trains began running near residences. It could be assumed that there would be some loss of privacy due to BART patrons being able to see into rear yards and houses. As shown in Figure 2.5, approximately 30% (or 21 miles) of the BART system is above-grade and close enough to expose ad-

[12] South Hayward, Ashby, Coliseum, Rockridge, San Leandro, Fruitvale and North Berkeley.

jacent houses and yards to potential loss of privacy. It was also possible that commercial advertising would respond to the new "audience" with increased signage and new locations.

FIGURE 2.2
AREAS OF POTENTIAL LOSS OF RESIDENTIAL PRIVACY



Methodology

In the Phase I study, determination of the extent of loss of privacy was limited to detecting any observable responses such as fences, window covering and more extensive landscaping. In order to accomplish this, photographs of selected residential areas were taken from the train and compared to a similar series taken in 1972.[13] In the Phase II study detailed surveys of affected residents will be conducted to obtain actual "feelings" of loss of privacy and visual exposure.

To examine the possibility of increases in commercial and general advertising signage, a systemwide visual check from BART trains was made and a representative of Foster and Kleiser, a large outdoor advertising company, was consulted.

The two basic issues concerning visual exposure are presented along with their respective findings.

Issues and Findings

Loss of Privacy

In which of the areas that are potentially exposed to view from BART facilities have there been observable responses to potential exposure and what types of response have occurred?

Residences near approximately 15 miles of BART line are exposed to potential loss of privacy. However, there are few observable responses to such loss. In one small area in Richmond, where apparent responses were observed, houses and yards are very close to the BART system. Passing trains run on a low embankment placing train windows a few feet above rear fences and house windows. The observed responses at this site are extensive, including high fence extensions and total window coverings.

BART-Directed Advertising

In which of the areas where there is potential for BART-directed advertising have there been actual changes in advertising and what types of changes have occurred?

Only two instances of signs clearly directed at BART were observed, neither of which is visible from nearby residences and

---

[13] Donald Appleyard, "BART Residential Environment Impact Study," Institute of Urban & Regional Development, for Metropolitan Transportation Commission, Berkeley (1973). This pre-BART photo study (completed in 1972) collected data on a wide range of environmental concerns including the privacy issue.

streets. Most communities along BART's right-of-way have enacted ordinances prohibiting advertising directed at BART riders in zones 330 feet to 1000 feet on either side of the tracks. However, many billboards and commercial advertising signs on adjacent arterials are visible from BART as well as from the arterials.[14]

In discussions with a Foster and Kleiser representative, it was indicated that outdoor advertisers were not interested in directing billboards at transit riders. Difficulties created by high train speed, frequent preoccupation of riders with reading and face-to-face conversation, and the inability of many riders to see forward were cited as incompatibilities between rapid transit and outdoor advertising.

[14]These signs predate BART in nearly every case according to Foster and Kleiser.

III. BARRIERS

DEFINITION AND SCOPE

The construction of the BART system inevitably resulted in changes to patterns of vehicular and pedestrian movement. These changes consist of both improvements in movement and restrictions to movement. While such changes can be regarded as necessary tradeoffs for the improved transportation provided by the transit system itself, the effect of BART on local and regional traffic and pedestrian movement is a potentially important impact on the environment.

The overall objective of the barrier analysis was to assess on a systemwide basis, the effect of BART facilities on the ease and hindrance of pedestrian, vehicular and shipping movement in areas adjacent to BART lines and stations.

A barrier is an impediment to the movement of vehicles or pedestrians. The effects of BART as a potential source of barriers extend beyond just the actions of BART itself to public improvement actions taken by adjoining communities in direct response to BART's construction. The psychological and social implications of barriers will be studied in the second phase of this study. The movement of concern in this study is that which crosses or runs immediately parallel to BART's alignment. The basic unit of movement was defined to be a point of access (local street, arterial, freeway or pedestrian path) that crosses or runs alongside BART. To the extent possible, the study was directed at assessing effects of the differences on movement between BART and as it would have been had BART not been built.

RATIONALE AND RESEARCH QUESTIONS

The purpose of the barrier study was to identify BART-related changes in local movement and to ascribe these changes to specific aspects of BART facilities and line configurations.

The possible sources of BART barriers are surface trackway and its fencing, various structures, station parking lots, maintenance yards, and changes in local circulation brought about by BART's construction that are not part of the

system itself. At the same time, grade separations and roadway improvements could mitigate BART-created barriers and even result in improvements in local circulation.

As with all aspects of the social environment, assessment of BART's impact depended on a comparison of present conditions to the pre-BART environment. That movement environment essentially is the movement pattern crossing and paralleling the alignment prior to BART's construction. A NoBART Alternative (NBA), which will provide a basis for comparing BART's impacts to what might have happened had BART not been built, has not been specified in detail as yet. However, it is clear that, with respect to barriers, the NoBART world is the same as the pre-BART world along the BART alignment.

To analyze BART's impact on local circulation, the following were determined:

- The pre-BART movement pattern and the effect of prior barriers along BART's alignment.
- The present status of movement.
- The specific elements of BART that have acted to bring about changes.

The examination of these barrier factors was posed in the following research questions:

1. What is the relationship between previous transportation facilities acting as barriers and BART?
2. Which BART line and station configurations have created barriers? Which have improved access and ease of movement?
    a. To what extent and where have local streets and pedestrian paths been blocked or eliminated by BART?
    b. To what extent and where have improvements to vehicular and pedestrian facilities resulted from the construction of BART?
3. What effect, if any, has the existence of the Transbay Tube had on maritime activity on the Bay?
4. What measurable changes in vehicular and pedestrian flows have resulted from BART changes in local and regional movement patterns?

Although the Environment Project in general has not considered impacts resulting directly from BART construction, the barrier study has addressed them because they have been and continue to be the major BART source of barriers.

5. What aspects of BART's construction have in the past and now create barriers to movement? Where?

METHODOLOGY

The assessment of barriers or circulation changes took place in three steps and considered all known instances of change systemwide.

First, a survey of circulation patterns, which included railroads, freeways, arterials, and local streets was conducted using aerial photographs[1965, Bay Area Transportation Study Council (BATSC)]. This was simultaneously compared to a similar survey of post-BART conditions[1] and all changes from the 1965 series of aerial photos were noted. These changes were then transferred to systemwide maps along with the locations of prior transportation facilities adjacent to BART alignment.

The second step consisted of conferring with BART representatives concerning the details of circulation changes, such as who initiated them, how extensive they were, and their relationship to BART design decisions. These conversations also identified changes not found in the aerial photo survey. In some cases field observations were made when other means failed to resolve questions. Research Question 3 was answered by telephone conversations with Coast Guard and Port of Oakland officials. Research Question 4 was satisfied by consulting local traffic engineers and school officials in Concord, Richmond and Hayward by telephone to determine any changes in traffic flows or school boundaries. These areas were selected because there are large segments of surface BART line in all three communities.

---

[1]Appleyard, D., op. cit.

In the third phase, counts of all crossings of BART alignment, both prior to construction and after, were made based on the previous mapping of circulation changes.[2] Each count was tabulated by type of adjacent transportation facility and by BART line configuration. Circulation improvements, including grade separations, were also counted and tabulated by adjacent transportation facility and BART configuration. Analysis consisted of comparisons of the pre-BART and BART tabulations to satisfy the first two research questions.

The fifth research question, concerning construction impacts, was addressed through conversations with BART representatives and field observations.

FINDINGS

The study findings are arranged in three parts. The first part discusses the movement and barrier environment in the four BART corridors prior to BART's construction. This condition is the baseline for comparisons. The second part presents the current BART movement and barrier environment. It discusses the changes brought about by BART, and the specific characteristics of BART responsible for change. The third part deals with the barrier effects of BART construction activities.

Pre-BART Environment

Approximately 85% of BART's alignment is adjacent to other transportation facilities which pre-existed BART and were crossed by nearly 300 streets, arterials and freeways.

Adjacent Transportation Facilities

As shown in Figure 3.1 there are four types of prior transportation facilities with which BART was aligned as well as a category of no prior transportation alignment. Of BART's 71 miles, some 20% is either adjacent to (3.9 miles) or in the median (10.2 miles) of freeways. Adjacent alignment was used where existing freeways were to be left unchanged by BART. Median align-

[2]Each point of crossing was given equal weight in the counts. Because of the very few losses of crossing points, detailed data on traffic flow at each crossing was not needed, allowing freeways, arterials and local streets to be considered as equal units.

ments have been used in two situations, one where a new freeway was being built in conjunction with BART, and another where an existing freeway was widened and partially realigned in conjunction with BART's construction. This latter case, Highway 24 from Orinda to Walnut Creek, would not have occurred had BART not been built.

TABLE 3.1
TRANSPORTATION FACILITIES ADJACENT TO BART ALIGNMENT

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
Miles	14.1	21.6*	5.2	18.3	11.8	71.0
Percent of 71 miles	20%	30%	7%	26%	17%	100%

* This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

Railroads, as an adjacent transportation facility, are separated into heavily used and lightly used lines. Heavy use railroads consist of those presently running between 12 and 30 trains per day, and one that had heavy use during the development of the surrounding area.[3] Heavy use railroads are adjacent to about 30% of the BART line. Light use railroads (less than five trains per day) parallel approximately 7% of BART line. There is only one railroad in this category, the Santa Fe line in Berkeley, Albany, El Cerrito and Richmond. Currently it runs two to four trains per day and at its maximum use does not exceed 10 trains per day.

Parallel arterials are located along about 26% of BART's 71 miles. Over 10 miles of arterials have BART in the median, while another 8 miles have it alongside.

Finally, approximately 17% of BART's alignment has no other transportation facility adjacent to it. BART's trackway in the Transbay Tube and Berkeley Hills Tunnel constitutes over half of this category, with small areas in Fremont, Walnut Creek, Oakland and Berkeley making up the remainder.

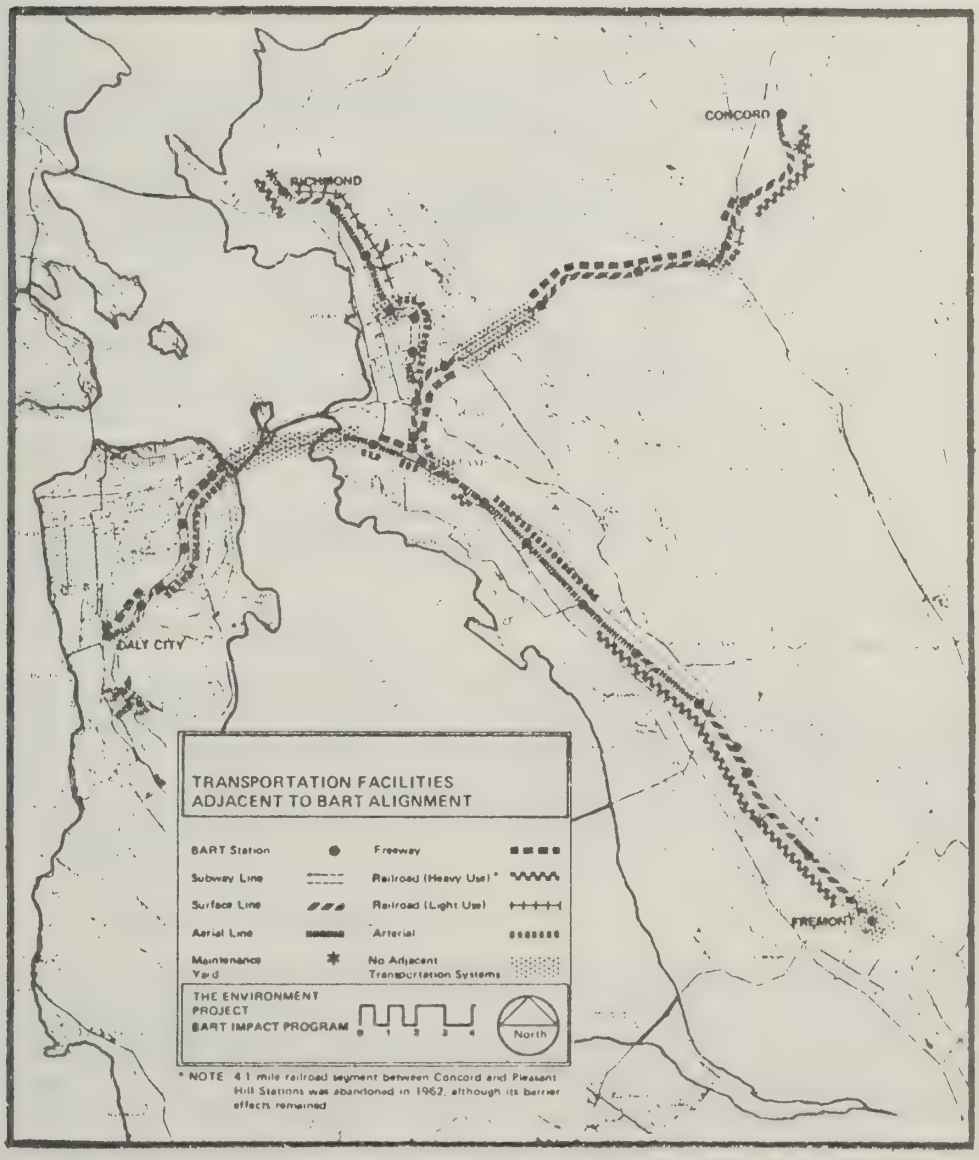
Cross Movement of Transportation Facilities Adjacent to the BART Alignment

The type of adjacent transportation has had an important effect on the intensity of cross traffic along BART's alignment.

---

[3]The Sacramento Northern Railroad in Eastern Contra Costa County was abandoned in 1962 after several years of minimal use to build the BART test track, which later became part of the Concord line.

FIGURE 3.1
TRANSPORTATION FACILITIES ADJACENT TO BART ALIGNMENT*



* See Appendix A-1 for more detail.

About one-third of BART's total alignment has intense cross movement where it is adjacent to arterials and lightly used railroads, while one-half has infrequent cross movement where it is adjacent to freeways and heavily used railroads.

BART alignment adjacent to heavily used railroad lines has the lowest incidence of crossings (2.2 per mile), with freeways being similar (3.0 per mile). However, lightly used railroads (6.2 per mile) and arterials (8.4 per mile) have much more intense cross movement, presumably because they offer less resistance to cross traffic (Table 3.2).

TABLE 3.2
ADJACENT TRANSPORTATION FACILITIES
AND CROSSING FREQUENCY (Prior to BART)

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
Miles	14.1	21.6 *	5.2	18.3	11.8	71
Crossings	43	47	32	154	15	291
Crossings Per Mile	3.0	2.2	6.2	8.4	1.3	4.1
Miles	35.7		23.5		11.8	71
% of 71 Mi.	50%		33%		17%	100%

* This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

Vehicular Grade Crossings

According to Table 3.3, about 18% of the crossings of transportation facilities adjacent to the BART alignment were grade separated. Of course, all of the freeways were grade separated while 11% of the heavily used railroads were grade separated. Lightly used railroads and arterials were virtually always crossed at-grade.

Pedestrian Grade Crossings

Pedestrians crossed transportation facilities adjacent to BART alignment in many places. About 185 of the nearly 300 points of crossing were used by pedestrians as well as vehicles. Approximately 75% of the pedestrian crossings crossed arterials and lightly used railroads and were not grade separated. Grade separations occurred at 24 points, primarily crossings of freeways. See Table 3.4.

TABLE 3.3
ADJACENT TRANSPORTATION AND
GRADE CROSSINGS/SEPARATIONS * (Prior to BART)

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
Miles	14.1	21.6 **	5.2	18.3	11.8	71
Crossings	43	47	32	154	15	291
Grade Separation	43	5	1	2	--	51
% of Category	100%	11%	3%	1%	--	18%
Grade Crossing	--	42	31	152	15	237
Grade Crossing Per Mile	--	1.9	6.0	8.4	1.3	3.3

* This table includes three exclusively pedestrian crossings.
** This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

TABLE 3.4
ADJACENT TRANSPORTATION AND PEDESTRIAN*
GRADE CROSSINGS/SEPARATIONS (Prior to BART)

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
Crossings	21	23	27	104	9	184
Miles	14.1	21.6 **	5.2	18.3	11.8	71
Crossings Per Mile	1.5	1.1	5.2	5.7	.8	2.5
Grade Separations	21	3	--	--	--	24

* In most instances pedestrian crossings are combined with vehicular crossings.
** This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

BART Environment

BART has generally avoided the creation of barriers by the use of either subway or aerial configuration in areas of intense cross movement.

As shown in Table 3.5 and Figure 3.2, about 95% of BART's alignment with cross movement from arterials and lightly used railroads is in subway or on aerial structure. Surface configuration has been used where cross movement intensity is low. Approximately 70% of the BART alignment immediately parallel to freeway and heavy use railroad facilities is surface configuration. The Transbay Tube and Berkeley Hills Tunnel represent 65% of the BART alignment without adjacent transportation. The Transbay Tube has had no effect on maritime activities on the Bay.

TABLE 3.5
ADJACENT TRANSPORTATION AND BART CONFIGURATION

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterial	No Prior Adjacent Transp.	Total
Subway Miles	1.3	--	.2	9.4	9.4[a]	20.3
Surface Miles	9.9[b]	14.8	1.0	--[b,c]	1.4	27.1
Aerial Miles	2.9[d]	6.8[e]	4.0	8.9	1.0	23.6
Total	14.1	21.6[f]	5.2	18.3	11.8	71.0

[a] 7.7 miles in Trans-bay Tube and Berkeley Hills Tunnel.

[b] .9 miles parallel to railroad (dominant prior barrier) not included.

[c] 1.1 miles parallel to railroad (dominant prior barrier, although it was abandoned to build BART Test Track in 1965) not included.

[d] 1.8 miles of short sections of aerial structure and bridges to accommodate cross traffic.

[e] 7.0 miles parallel to arterial (dominant prior barrier) not included.

[f] This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

Only twelve of the almost 300 streets and pedestrian paths crossing BART alignment were blocked. Generally the street closings were requested or unopposed by local communities and none involved major traffic streets. All pedestrian paths were replaced with grade separations. Three streets around the North Berkeley station were closed by the City of Berkeley in an attempt to protect the surrounding neighborhoods from

FIGURE 3.2
BART-RELATED CIRCULATION IMPROVEMENTS*

* See Appendix A-3 for more Detail

the anticipated traffic flow from the BART parking lot. (These street closings are not included in tabulations of circulation changes.)

In Richmond, Concord and Hayward, continuous pedestrian access across BART alignment was terminated by the fencing of BART surface line resulting in a general increase in pedestrian safety. However, the four pedestrian bridges and three vehicular/pedestrian underpasses replacing the nearly four miles of continuous access are less convenient than previously. In addition, local citizens from two of the three affected areas, Richmond and Hayward, attempted to get more pedestrian access across BART right-of-way than was ultimately provided. The social implications of creating such discontinuities to movement will be investigated by interviews in affected areas during the second phase of this study.

In these same three areas (Concord, Richmond and Hayward), where BART runs on-grade and major cross traffic changes have been made, local traffic engineers felt that little change in traffic flow had occurred.

Several improvements in safety and ease of movement have been provided as a result of BART construction.

Major streets have been grade separated from BART and adjacent transportation, and new streets and improvements to existing roadways have been provided parallel to BART alignment in several areas, as shown in Figure 3.2 and Appendix A2.

As can be seen in Table 3.6 and Figure 3.2, 32 of the 40 improvements to cross traffic occurred in areas where BART line is adjacent to freeways or heavy use railroad.

Improvements to roadways parallel to the BART line were more evenly distributed among different types of adjacent transportation facilities. The major parallel improvement was nearly 7 miles of Highway 24, from Orinda to Walnut Creek, which was widened from 4 and 6 lanes to 8 lanes.

In addition, three major urban boulevards were refurbished and traffic improvements made: Market Street in San Francisco, Broadway in Oakland and Shattuck Avenue in Berkeley. Other arterials were widened and medians installed. More than 3-1/2 miles of linear park was created through Albany and El Cerrito along the little used Santa Fe railroad. Over 5 miles of new or improved frontage road was provided where BART surface line is adjacent to heavy use railroad.

About 45% of prior railroad crossings were improved. Sixteen of these improvements were new grade separations for vehicles and pedestrians. Railroad grade separations occurred in Richmond, Hayward, Union City and San Lorenzo.

TABLE 3.6
ADJACENT TRANSPORTATION AND CIRCULATION
IMPROVEMENTS RESULTING FROM BART

	Freeway	Heavily Used Railroad	Lightly Used Railroad	Arterials	No Prior Adjacent Transp.	Total
Cross Traffic Improvement	11	21	0	5	3	40
Number of Crossings	43	47	32	154	15	291
% Crossings Improved	25%	45%	--	3%	20%	14%
Miles of Parallel Improvement	6.7	6.0	3.6	7.6	--	23.9
Miles of Adjacent Transp.	14.1	21.6 *	5.2	18.3	11.8	71.0
% of Category	48%	28%	69%	42%	--	34%

* This includes 4.1 miles between Concord and Pleasant Hill stations which were originally heavily used but were abandoned in 1962.

Table 3.7 and Figure 3.2 show that the majority of the cross traffic improvements were made where BART was on surface trackway. Over half of the crossings of BART surface line were improved.

Parallel improvements are evenly distributed among the three types of configuration. Almost 40% of BART line, excepting the Transbay Tube and Berkeley Hills Tunnel, has been accompanied with parallel improvements for motorists and pedestrians.

In Concord the BART line is on an earth embankment, which physically and visually separates a residential area from an industrial area. After seeing the positive effect BART has in separating these two incompatible land uses, the community decided to drop plans to bridge BART and connect the two areas with a main street.

Although not as dramatic, a similar effect has been achieved in Union City. An earth embankment and the Union City station have partially separated heavy industrial facilities from a new residential area.

TABLE 3.7
BART CONFIGURATION AND CIRCULATION IMPROVEMENTS RESULTING FROM BART

	Subway	Surface	Aerial	Totals
Cross Traffic Improvements	3	30	7	40
Number of Crossings	116	55	120	291
% of Category	3%	55%	6%	14%
Miles of Each Configuration	12.6*	27.1	23.6	63.3*
Miles of Parallel Improvement	4.6	12.0	7.3	23.9
% of Category	36%	45%	31%	38%

* 20.3 miles total subway minus 7.7 miles Transbay Tube and Berkeley Hills Tunnel.

Barrier Impacts During Construction

The downtown areas of San Francisco, Oakland and Berkeley were the scenes of extensive construction activity to put BART in subway beneath main streets. In San Francisco there was also extensive construction activity to build a subway for undergrounding the Municipal Railway. These construction activities resulted in innumerable small detours and inconveniences to motorists and pedestrians which ranged in duration from about two years in Berkeley to more than seven years in San Francisco.

The construction of stations in subway segments is perhaps the greatest part of the problem because of the need to dig up the surface of the street, whereas connecting subway line can often be tunnelled leaving the surface relatively untouched. However, nearly 30% of the length of Market Street from Civic Center to the Embarcadero has subway stations beneath it, which intensified the effects of cut-and-cover construction along this street, one of the most important downtown streets in the region.

Pedestrians are particularly vulnerable to subway construction impacts. Most pedestrian activity in the region is concentrated on the areas where impacts are greatest. Temporary solutions acceptable to motorists are frequently dangerous and unpleasant to pedestrians. Transit services have often been affected by subway construction.

IV. SAFETY

DEFINITION AND SCOPE

This analysis of BART's safety impacts includes determination of changes in the occurrence of traffic and non-traffic accidents and accident potential attributable to BART in areas adjacent to BART stations. These areas include BART parking lots and along the BART line.

General Definition of Impact

BART's impacts were defined as appreciable differences in accidents or accident potential between what has occurred with BART and what is most likely to have occurred had BART not been built. In view of the necessarily subjective nature of much of the available data, an impact was accepted as significant only when more than one type of data or informed source yielded credible evidence of meaningful differences or changes within the local context. This evidence included opinions of public officials, official police spokesmen, patrolmen's unofficial observations, citizens' reports, accident statistics and observation by trained study staff. A process of verification through complementary sources was a central element of the study.

Traffic accidents were considered to be conflicts involving (a) moving or parked street vehicles (autos, buses) versus street vehicles, (b) single street vehicles, or (c) street vehicles versus pedestrians. Non-traffic accidents included (a) BART trains versus street vehicles or pedestrians and (b) pedestrian accidents which are not related to traffic conditions (e.g., a fall down a station ramp).

STUDY AREAS

Stations

The station locations studied included parking lots as well as nearby streets. Accidents and accident potential in BART parking lots were studied even though the lots are BART facilities and therefore, strictly speaking, not elements of BART's surrounding environment. This was done partly because aspects of the parking lots which may be causing accidents within lots may also affect safety outside the lots. Study was also made of streets within one to three blocks from stations.

Selection of boundaries was influenced by population density, land use and street configuration type as well as by aggregation of available data.

Line Areas

BART line areas were defined as those areas immediately adjacent to the BART right-of-way between stations. Adjacent areas studied were primarily within one block of the trackway. It was assumed (from preliminary study) that changes in accidents or accident potential would be most likely to occur within this area.

TYPES OF CHANGES STUDIED

This study focused on two types of changes:

- Number, rate or distribution of traffic and non-traffic-related accidents, and
- Accident potential, i.e., the likelihood that accidents may occur.

The types of accidents of most interest were those which result from the presence of new (BART) structures or the activity centering around them, and affect population groups living in and traversing areas outside stations and BART line.

RESEARCH QUESTIONS AND RATIONALE

This study began with an inductive effort to generally identify BART-related impacts and probable impact causes. This was followed by the creation of a series of research questions addressing what had been identified as key issues, a description of expected findings, and formation of methods of assessments.

Since it was not feasible to answer the research questions related to BART's traffic safety impacts in streets adjacent to stations by detailed studies at all stations, station sites were selected for study. When possible, selected site findings were generalized to other station areas where less intensive studies were conducted.

Structuring The Approach

Gathering General Information

As in the companion analysis of BART's security (crime) impacts, a general information gathering effort was conducted to begin

to determine extent, locations and likely causes of BART's safety impacts. This early inductive effort involved location of prior studies of the types of accidents which could occur (e.g., moving vehicle versus parked vehicle conflicts) and their probable causes.[1]

Interviews with Public Officials

During the first phase of the Environment Project's community monitoring program, public officials, including planners and police in all local jurisdictions adjacent to the BART line, were asked whether BART had created or accentuated safety problems. BART police spokesmen were also asked to identify changes and probable causes which might be related to BART.

Observations

Finally, observations were made to gain familiarity with traffic safety conditions during periods of most and least stress of traffic facilities (i.e., peak periods and midday) and also to find traces of trespassing in BART line areas.

Following this, preliminary impact areas and probable causes of changes in accident or accident potential were listed.

Line Versus Station Area Impacts

Early indications were that traffic safety was affected by BART less often and to a lesser magnitude in line areas than in station areas. In addition, such effects in BART line areas appeared most often to be related to changes in traffic facilities resulting from the introduction of the BART structures. However, in station areas traffic-related impacts seemed to result most often from changes in volumes and movement of BART-related pedestrian and vehicle traffic.

Non-traffic safety, primarily related to trespassing onto the tracks, was hypothesized to be changing in BART line areas and particularly those areas with lines at-grade more often than in station areas.

Urban Versus Suburban Area Impacts

It also appeared highly probable from the preliminary review that the type and extent of traffic and non-traffic safety impacts might be related to location in urban versus inner/outer suburban areas. In urban areas, i.e., high density areas within the core of central cities, the BART line is typically underground, while in other areas most of the line is above

---

[1]See Bibliography.

ground. Because of this difference, it seemed that areas outside the high-density (subway) core would be more likely to be affected.

In station areas, both BART-induced and background traffic levels, land use, and population density appeared from the initial evaluation effort to be key contributory factors in safety impact occurrence. Suburban station areas tend to have medium to low levels of (primarily vehicular rather than pedestrian) background traffic, and traffic facilities designed to control these volumes. In contrast, background traffic in urban core areas tends to be high with a high mode mix of pedestrians, autos and buses. BART-induced traffic at suburban stations runs from low to high volumes, mostly autos, and most of the suburban stations have parking lots. Urban core area stations, on the other hand, generally have high volumes of pedestrians and buses with little automobile access activity and no parking lots.

Suburban stations tend to function primarily as "collectors" of patrons from homes, and often lie in at least partially residential areas. Urban, core area stations tend more to be "distributors" to jobs and other activities. Despite this general role, however, urban station areas typically have higher net population densities, where population exists at all, than do suburban areas.

Resultant Research Questions and Expected Findings

Traffic Safety: Lines

Have traffic accidents or accident potential changed disproportionately near BART lines in center city or suburban areas?

From preliminary observations and interviews with police spokesmen and public officials, it was expected that BART changes in street configuration or BART operations did not generally affect traffic safety except where there were BART-related grade separations. However, it appeared that construction of subway lines in center city areas had been disruptive to traffic.

Traffic Safety: Urban Stations

Have traffic accidents or accident potential changed significantly in center city station areas and been attributed to BART?

From initial interviews with public officials, it appeared that traffic safety generally did not change due to BART. However, it did appear that pedestrian movements had changed somewhat.

Traffic Safety: Suburban Stations

Have traffic accidents or accident potential changed significantly and been attributed to BART in suburban station areas?

From the preliminary inductive study, it was clear that in order to form a meaningful answer to the general question above, accidents and potential accident occurrence needed to be classified into three types. This classification is shown below:

- Accidents and potential for accidents involving:
  - -- Parked autos on streets nearby stations.
  - -- Single moving vehicles, or one or more moving vehicles versus other vehicles or pedestrians on streets nearby stations.
  - -- In station parking lots.

Parked Auto Accidents and Accident Potential on Station-Adjacent Streets: Accident increases appeared to be only occurring at one station (Daly City) which has a greater number of autos parked on adjacent streets than any other BART station. However, it was evident that the potential for accidents was high at other stations with overflow parking lots.

Other Accidents and Accident Potential on Station-Adjacent Streets: It appeared that accident increases were occurring or accident potential was high near some stations where there were medium to high BART-induced traffic volumes. However, no changes appeared to be occurring at stations with low patronage. In most areas, accident trends on streets near BART had not been formally studied by local officials.

Station Parking Lot Accidents and Accident Potential: Observation at BART parking lots suggested that inter-modal conflicts and inconsistencies in signing might be creating hazards, particularly at lots which were at or over capacity.

Non-Traffic Safety

Has BART had any significant effects on non-traffic safety in line or station areas?

Initial interviews with BART and local officials indicated that non-traffic safety incidents had not been significant with the exception of generally isolated trackway trespassing incidents. It appeared that pedestrian overpasses in locations where BART and railroad alignments were parallel had increased safety.

METHODOLOGY

It appears that the approach used in this study can be useful to planners in other areas studying safety impacts of rapid transit systems. As with other aspects of the social impact study, the initial phase involving gathering general information, observations, and interviews with police and public officials laid the groundwork for a later more deductive approach. Interviews were held not only with agency spokesmen but also others, such as traffic engineers with special projects in the BART area and patrolmen with a high personal familiarity with safety conditions in specific BART line and station areas. (Sources are listed in Appendix B2.) Early in the study it was found that few local jurisdiction public officials had formally studied accident trends near particular station areas even when BART-induced problems were recognized. However, police officers and patrolmen were generally informed about traffic conditions; it appears likely that this situation is not limited to the Bay Area.

From the initial phase, research questions were formed to address main issues, and were helpful in establishing the framework for further study. Expected findings were recorded to be used as a basis for further data gathering, and were assumed to be preliminary findings until proven otherwise.

It seems that employing case studies (primary sites) to conduct detailed studies of traffic safety may be useful but somewhat limiting in other areas. It was found in this study that it was necessary to have a generally high degree of familiarity with street configuration and traffic controls at all stations to determine effects of BART-induced volumes. Similar BART-induced volume levels in areas with similar background traffic levels, density and land use did not necessarily mean that BART impacts would be similar. Specifics about street configurations and traffic controls can override the changes in traffic volumes. To counteract the problem of wrong assumptions when generalizing from case study sites to all station sites, inventories of street configurations and traffic controls prior to and following BART's presence (BART-induced controls were identified) were made when the data was available. In addition, interviews at all station sites contained questions about the interaction between increased traffic volumes due to BART and street configuration and traffic controls.

The principal means of distinguishing case study areas from other areas were study of accident data and repeated in-depth interviews at case study sites.

FINDINGS

Pre-BART Environment

It was necessary to form an assumed "NoBART" baseline with which to compare present conditions, in order to define and determine the existence of an impact. This baseline is made up of an assumed description of the distribution of traffic and non-traffic safety impact determinants, traffic volumes, freeway and road construction, traffic controls, population density, and land use in hypothetical present-day environment without BART. This chapter presents these assumptions.

This baseline condition is basically an update of pre-BART conditions to the BART timeframe. It is built on the BART Impact Program's Generalized NoBART Alternative[2] with further specification provided by the present study team's compilation of specific changes which would likely have occurred regardless of BART's presence and those which could have occurred only if BART had not been built. Interviews with local public officials and traffic engineers are the major sources of these further inputs to the baseline description.

Safety Determinants

It is assumed that the distributions of traffic volumes, freeway and road construction, traffic controls, population density and land use in a present day environment without BART may have been different from present actual conditions in some areas.

Traffic Volumes: In general, it is likely that without BART, auto traffic volumes would not have increased at the rate which is now occurring in the Concord, Moraga and Danville-to-Oakland corridor since the freeway serving this corridor would be six rather than eight lanes. In addition, it appears that without BART, there would be more bus traffic, particularly in the East Bay-to-San Francisco corridor and from southern areas of San Francisco to downtown.[3]

However, without BART, it is likely that the concentrations of auto, pedestrian and bus traffic which have occurred around the majority of BART stations, many of which are in residential areas, would not be present. (Source: Systemwide accounting of BART-induced bus changes and examination of traffic volumes changes, particularly in selected site areas.)

---

[2]"Formulation of the Generalized NoBART Alternative", Metropolitan Transportation Commission, February 15, 1975.
[3]Ibid.

For example, in Lafayette, prior to direct BART service to San Francisco, commute traffic was concentrated around the Greyhound bus terminal in the downtown area. Since BART, this traffic has shifted west to the BART station.[4] Another example of likely differences in traffic volumes between a BART and NoBART environment is in the downtown Hayward area near a BART station. In this area, traffic volumes were declining until BART began service. Now traffic volumes are increasing on some streets. Therefore, it is likely that without BART, this area's traffic volumes would have continued to decline.[5]

Freeway and Road Construction: Without BART, it is likely that most of the road configuration changes which occurred near BART lines and stations would not have taken place. Specifically, it is likely that Lafayette would not be the site of a major freeway interchange. In Daly City, Knowles, a major arterial that intersects with a freeway, would probably not have been widened. In El Cerrito, the streets surrounding the del Norte station would not have been converted to one-way operation. However, in Pleasant Hill, according to County officials, it is likely that the major freeway access road which crosses in front of the BART station would have been widened as it has been with BART.

Traffic Controls: Without BART, it is likely that traffic controls would not have been added near what are today medium or heavily patronized stations, particularly in suburban areas, except where non-BART related population growth has occurred.

Population Density: Thus far, it appears that population density in a NoBART environment would not be different than it is today. Populations would be increasing in outer suburban areas and declining in urban areas. One exception may be the recently experienced high levels of growth in the Moraga and Concord areas, which may be contributed to by the BART-related additional freeway lanes and the attractiveness of BART service. (This speculation is based on impressions of public officials in northern Contra Costa County.)

Land Use: Thus far, it appears that land use in the BART environment does not differ from that of an environment without BART except where station and line areas have replaced other land uses, and in the Concord, Moraga area where possible BART-induced growth has occurred. No mention is made of land use differences in the Generalized NoBART Alternative; further study of this possibility will be a major effort of another project.

---

[4]Source: Interviews with Lafayette public officials.
[5]Source: Interviews with Hayward public officials and analysis of traffic volumes data, 1972 through 1975.

The BART Environment

Traffic Safety: BART Line Areas (away from station)

Generally, no significant changes have occurred in line area traffic safety resulting from BART operations or facilities. However, there is some evidence that traffic disruption occurred during construction of BART underground lines.

From observation, as well as discussions with BART and local officials, it is evident that no significant BART-related traffic safety impacts have occurred in BART line areas with the following possible exceptions:

- Safety Improvements

  Pedestrian Overpass: According to BART officials, pedestrian safety has been increased on Seventh Street in Oakland where the BART line emerges from the Transbay Tube. A pedestrian overpass which connects Maritime Street and the Navy Depot was built here. Prior to the construction of the overpass, pedestrians were required to cross Seventh Street, which is heavily used by trucks.

  Urban Street Improvements: According to BART and local public officials, widening of sidewalks, improved signalization, and lighting have enhanced pedestrian safety in San Francisco, Berkeley and Oakland downtown areas. Parking and traffic lane improvements have also improved driving conditions from the south portion of Berkeley to Shattuck Avenue in the view of BART officials. It appears that these improvements are BART-induced but further study is needed to establish a relationship.

  Vehicular Grade Separations: BART has also improved circulation and safety in several locations by vehicular grade separations where roads previously intersected railroads. Three such vehicular underpasses were designed by BART and built by the City of Hayward in that area. In the Richmond area, four such vehicular grade separations were built (37th, Nevin, Barrett and Kearny). Between the Pleasant Hill and Concord stations, Bancroft Avenue and Oak Grove were grade separated.

- Reduced Safety

  BART Line Construction: BART construction, particularly cut and cover construction portions of subway lines in center city areas, was considered by those interviewed to have decreased safety. Public officials in all three center city areas stated that BART construction disrupted traffic and may have caused more accidents. However, none of the cities had made a formal study of changes in accidents.

  Observation of current BART-related construction areas in San Francisco revealed that (a) often traffic regulations are unclear if present and (b) the allowed directions of traffic flow and regulations change often.

Statements of BART and local public officials, as well as direct observations, are supported by findings from the "Pre-BART Data Analysis". Respondents near BART subways reported adverse impacts much more frequently than did those near above-ground sections. In some cases subway-area respondents were as much as twice as likely as others (up to 60 percent) to report their experience with general construction impact as unpleasant.[6] However, despite more frequent reports of construction impact in subway areas, the "special sites" data showed that such impacts were most frequently mentioned at primarily above-ground stations with parking lots.[7]

Traffic Safety: Center City Station Areas

Traffic and pedestrian safety in center city station areas has not been significantly affected by BART, although pedestrian movements are different and sometimes more concentrated.

The above assertion is supported by case study results at one downtown station (Powell/Market) and generalization of case study results to the seven other urban core area stations. The Powell/Market station area was selected as the case study site for this analysis because it has BART-induced bus and pedestrian levels and background traffic volumes (i.e., impact-influencing characteristics) which are representative of urban station areas.

Case Study - Powell/Market Station: Powell/Market station mezzanines, street improvements and virtually no change in bus traffic appear to have at least maintained, if not increased, levels of safety

---

[6] Pre-BART Data Analysis, Environment Project Technical Memorandum (Draft), March 1975, p. 3.

[7] Ibid, p. 3.

which would be associated with a NoBART environment, although pedestrian concentrations and movements are somewhat different.

According to interviewed San Francisco officials, accident trends and accident potential generally have not changed and been attributed to BART-induced traffic within the adjacent areas to station entrances and exits.

Although patrons are concentrated at six exits/entrances (about 2300 AM peak period exit patrons and about three times this amount during midday), major streets are generally not more crowded than they would be without BART. About 85% of the AM peak patrons walk to destinations while 14% use bus service. BART mezzanines beneath the streets seem to have eliminated much of the street crossing by patrons.

Street widenings and improved lighting in the areas surrounding the Powell/Market station have helped to reduce hazards created by increased concentrations of downtown pedestrians. BART and public officials assert that improved traffic controls have helped to maintain levels of safety around this and other downtown stations. This was supported by observation of pedestrian movement around the Powell/Market station.

At the Powell/Market station, as with most other urban station areas, bus traffic has not changed significantly. Also, it is likely that BART operations at the Powell/Market and other downtown stations have not significantly affected the number of auto trips to downtown, according to interviewed San Francisco officials. However, an Oakland and San Francisco downtown parking survey being conducted by another BART Impact Project should provide a test of this contention.

Generalization to All Center City Station Areas: It appears that other urban station areas and related improvements have generally not created significant differences from probable NoBART safety levels. However, the other seven urban core sites vary somewhat in either numbers or peaking of patronage with the Powell/Market station.

Table 4.1 shows the number of AM peak exit patrons for each center city station on a typical weekday. Also included are estimates of the number of persons who walk from the BART stations to their destinations and those who complete their trips by bus.

As in the Powell/Market station, at the other urban stations, BART mezzanines appear to have reduced the hazard of significant numbers of patrons in on-street areas. Street and

lighting improvements in the remainder of the San Francisco urban area as well as in Oakland and Berkeley have also contributed to improving safety. As in the Powell/Market area, it is likely that these projects were BART-induced.

According to transit property spokesmen, in other San Francisco and Oakland urban station areas (including the Mission Street stations) bus service has generally not increased.[8] However, stops have been adjusted so that patrons can be picked up (and, in many cases, also dropped off) adjacent to station entrances. There is an exception in Berkeley. "Humphrey Go-BART" shuttle buses, connecting the University campus to BART, pick up and drop off passengers across the street from the BART station about ten times during an average peak hour. Public officials have expressed concern that pedestrians often run across the street to catch shuttle buses, thereby creating a hazard to themselves and to auto drivers. Observations supported these concerns. Pedestrians were seen exiting the station and crossing the street in 5 to 20 person groups without regard to traffic regulations to catch the Humphrey Go-BART shuttle.

TABLE 4.1
URBAN STATION AREAS BY A.M. PEAK PERIOD EXIT PATRONS

	A.M. PEAK PERIOD[a]		
	Exit Patrons	Pedestrians[b] n (%)	Bus Riders[b]
POWELL/MARKET[d]	2,274	1,950(85)	300(14)
OTHER SITES			
San Francisco			
Montgomery	14,702	13,800(94)	750(5)
Civic Center	2,388	2,200(93)	
24th/Mission(enter)[c]	816	550(67)	100(10)
16th/Mission(enter)[c]	375[d]	250(66)	50(13)
Oakland			
12th Street	1,721	450(27)	1,050(60)
19th Street	2,643	750(28)	1,350(32)
Berkeley			
Center City	1,430[d]	500(35)	650(46)

a. Exit patrons 6:30 AM - 9:00 AM, Wednesday, February 12, 1975, BART
b. Mode estimates based on BART Passenger Profile II, May 1974, and AC-BART transfers, rounded to nearest 50.
c. Entrance patrons chosen since this is direction of major traffic flow.
d. There are over twice as many exit patrons during midday.

[8]As of February 1975, lines have been extended to serve the 16th/Mission station (Route 26) and the Powell/Market station (Route 25,80).

BART might be affecting auto volumes in downtown areas. One Oakland official stated that auto volumes have been reduced because of former auto users now using BART. No definitive evidence of this was found, but a downtown parking survey (part of the BART Impact Program) should provide a test of this contention.

Traffic Safety: Suburban Station Areas

Generally, no significant BART-related changes in incidence or distribution of accidents involving autos parked on streets adjacent to stations appear to be occurring. However, significant increases in other moving vehicle conflicts attributed to BART have been found to occur in some station areas where there are medium to high levels of BART patron traffic. Accident increases of both types mentioned above are expected in the future in some station areas.

No appreciable changes in reported station parking lot accidents were found. However, the high mix of pedestrians, autos and buses in some parking lots may be contributing to high accident potential.

Moving Versus Parked Vehicle Accidents: No significant BART-related increases in accidents involving parked cars in neighborhoods adjacent to stations generally appear to be occurring except at one station. There, parked auto and moving vehicle volume increases due to BART were high on several two-lane residential streets. However, future BART-related accident increases can be expected at other station areas.

Approach: Potential for significant changes in occurrence of on-street accidents involving parked vehicles was examined for all 25 suburban station areas. Significant on-street parking by BART patrons (a major determinant of increased accidents involving parked autos) was found at nine of the 25 stations, two of which do not have parking lots. Of these nine sites, Daly City, the station with more than twice the on-street patron parking of any other station with overflow parking, was the only area where significant accident increases were found. To assess why accident increases were occurring at Daly City, safety-related conditions in this area were compared to those in an area with the high accident increase potential but no significant change in accidents (Glen Park).

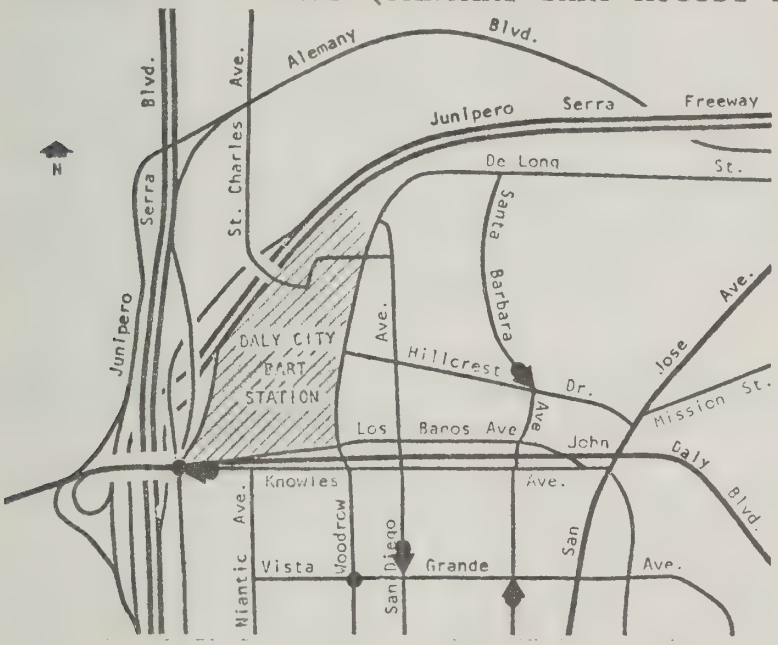
Description of Impacts at Primary Site (Daly City): Comparing two similar time periods, pre-BART (1-73 through 8-73) and BART, pre-Transbay (1-74 through 8-74), the number of accidents in-

volving parked autos was three during the pre-BART period and ten or eleven[9] during the BART, pre-Transbay period.

Locations of reported parked auto accidents for the two study periods are shown in Figures 4.1A and 4.1B.

DALY CITY: COMPARISON OF PRE-BART AND BART ACCIDENTS

FIGURE 4.1A
PRE-BART ACCIDENTS (JANUARY THRU AUGUST 1973)



Weekday
6:00 AM - 8:00 PM

Total = 6

Legend:

- ● One Accident
- ○ Each Additional Accident
- ▶ Direction to Nearest Intersection

Source:
State Accident Report

FIGURE 4.1B
BART, PRE-TRANSBAY ACCIDENTS (JANUARY THRU AUGUST 1974)

Weekday
6:00 AM - 8:00 PM

Total = 21

Legend:
See above

Source:
State Accident Report

[9]The presence of parked autos may have contributed to the eleventh accident. In a summary the accident was reported as caused by "obstruction of vision".

Daly City police spokesmen stated that patron parked on-street autos (there are over 1000 patron autos parked on nearby station streets) and increased BART-induced traffic volumes seemed to contribute significantly to accident increases.

Primary Site Comparison, Daly City Versus Glen Park: In order to assess apparent causes of safety impact in Daly City, the distribution of safety impact determinants was compared for Daly City and Glen Park. Glen Park is a station with high accident potential but an insignificant change in accidents. Glen Park's high accident potential comes from the fact that it is a heavily traveled medium density area. Also, the station has no parking lot and BART-induced traffic fills on-street parking spaces to capacity. Like Daly City, Glen Park is adjacent to a major freeway access street.

However, differences in the distribution of accident-related determinants between the two sites appear to outweigh similarities. These differences are listed below:

- On-Street Parking Increases: Although both stations now experience full occupancy of on-street parking spaces, the increase at Daly City was greater than at Glen Park. At Daly City, the number of autos parked in the area within two to three blocks of the station rose from 250[10] before BART to at least 1250;[11] while Glen Park experienced an increase from 154 on-street vehicles (11-2-73, AM) to 344 vehicles (12-19-74, AM).[12]

- Traffic Increases: The increase in BART-induced traffic was significantly greater at Daly City than at Glen Park. Glen Park has between one-third to one-fourth the number of peak period drop off/pick up vehicles (300 vs. 1100) and about one-fourth the number of vehicles finding or leaving parking spaces during each peak period (600 vs. 2000 vehicles).[13]

- Street Configuration: Daly City station, unlike Glen Park, is generally surrounded by a narrow street configuration[14] with particularly limited capacity where parking accident increases are occurring. All the reported accidents involving parked autos in the Daly City station area occurred on sloping narrow two-lane

---

[10]Daly City Police officials.
[11]Conrad & Associates, "Daly City Fringe Parking Study," estimate of 1000 parked autos (June 1974); for BARTD.
[12]San Francisco Department of Public Works Parking Survey.
[13]February 1975 patronage counts.
[14]With the exception of John Daly Boulevard.

residential streets with full occupancy of all-day parking spaces most of the day. Further, observers noted that on the two lane streets with autos parked on both sides of the street, autos frequently had to slow down when meeting oncoming cars.

Secondary Study Sites: Unlike Daly City, no appreciable BART-related changes in accidents involving parked autos were found at the seven other station areas with significant on-street BART patron parking [15] (defined as being 100 or more cars per day). These sites are Concord, Pleasant Hill, Walnut Creek, Lafayette Union City, Fremont and Balboa Park. Interviewed police and public officials at all of these sites asserted that the incidence of parked auto accidents had not changed significantly. Parked auto accident problems appear to be less severe in these other sites because each site differs from Daly City in one or more physical conditions proposed to be determinants of parked auto accidents. Table 4.2 shows the distribution of major parked auto accident determinants among these sites.

TABLE 4.2
STATION AREA BY DETERMINANTS OF BART-RELATED PARKED AUTO ACCIDENTS

	DETERMINANTS			
Station Area	On-Street Patron Parked Autos[a]	Background Traffic Levels[b]	BART-Induced Traffic (AM Peak Period) (Autos)	Predominant Street Configuration[c]
Daly City	1,000	Medium-Low	4,200	Minor
Glen Park	350	Medium	1,250	Minor/Major
Concord	100	Medium-Low	2,100	Minor/Major
Pleasant Hill	100	Medium-Low	1,900	Minor/Major
Walnut Creek	150	Medium-Low	2,100	Minor/Major
Lafayette	150	Medium-Low	1,300	Minor/Major
Union City	350[d]	Low	1,200	Minor/Major
Fremont	550	Low	2,000	Minor
Balboa Park	300	Medium	1,000	Minor/Major

a. Maximum per day based on (a) BART's calculation of parking lot spaces prior to January 1975, (b) estimate of AM peak period drive alone and carpool autos derived from BART's Passenger Profile II Survey, May 1975, BART to AC Transfers, November 1974, and Peat Marwick Mitchell's Transbay Riders Survey, 1975.

b. Based on available traffic counts and observation

c. Minor streets are 2-lane streets while major streets are 4-lane streets.

d. Prior to 1-27-75 when additional parking lot opened.

[15] The ninth station with significant BART patron on-street parking, Glen Park, is discussed above.

Table 4.2 also shows that background traffic levels and street configuration in the area surrounding the Daly City station do not differ appreciably from that at the other sites. However, the BART-induced stationary and traffic flow levels at Daly City are significantly greater than elsewhere. In areas where numbers of parked on-street patron autos begin to approach those for Daly City (Fremont, Union City and Balboa Park), other non-BART-related characteristics (i.e., background traffic levels or predominant street configuration) tend to ameliorate potential impacts. At Pleasant Hill, Lafayette[16] and Union City (since 1-27-75), parking areas off roadways have generally reduced chances for accidents involving parked autos.

Generalization to All Suburban Sites: It appears that other suburban sites with insignificant on-street patron parking (15 stations) also show no appreciable BART-related changes in parked auto accidents.[17] However, future changes in BART operations or increased population growth may cause adverse impacts in certain areas. Increased bus service, particularly in areas which now have significant on-street parking may reduce the potential for parked auto accidents. Table 4.3 shows the present supply of BART off-street parking spaces and future characteristics which may affect this supply.

It appears from this table that the following groups of stations may experience significant increases in parked auto accidents in the future:

- Station areas with (a) presently no available lot spaces, (b) a propensity for future population growth or development, and (c) no known plans of lot expansion or increased bus service. In particular, areas with two-lane residential streets near the stations may be adversely affected. The station areas fitting this description are:

  Concord
  Pleasant Hill
  Bayfair
  Balboa Park

  All of the above, except Balboa Park, are likely to be affected by nearby population growth. At Balboa Park, a bus yard is being expanded which will generate additional traffic.

---

[16] In August 1974 the City of Lafayette purchased a state-owned vacant lot which was being used by BART patron parkers.

[17] This assertion is based on interviews with public, BART, and police officials.

TABLE 4.3
POTENTIAL FUTURE PARKED AUTO ACCIDENTS BY STATION AREA*

Station Area	Off-Street Supply Excess Parking Lot Spaces		Future Change			Areas of Potential Future Parked Auto Accident Increases
	Present Capacity	Spaces Not Filled** (Jan. 1975)	Propensity for Future Population Growth or Development	BART Operations or Parking Facilities Changes Lot Expansion Planned	Operations Increases	
Concord	1,059	0	Yes			•
Pleasant Hill	1,337	0	Yes			•
Walnut Creek	1,114	0	Yes	Application Submitted		
Lafayette	650	0				
Orinda	939	166				
Rockridge	776	147				
MacArthur	450	0				
Richmond	784	462	Yes		Direct S.F. Service	•
El Cerrito del Norte	985	138			Direct S.F. Service	•
El Cerrito Plaza	509	91			Direct S.F. Service	•
North Berkeley	500	130			Direct S.F. Service	•
Ashby	560	352			Direct S.F. Service	•
Fremont	700	0	Yes	fall 1975		
Union City	810					
Bayfair	1,408	0	Yes			•
San Leandro	1,106	265				
Fruitvale	730	0				
Coliseum	923	738				
Lake Merritt	240	0				
Daly City	820	0		planned 1975-6		
Balboa Park	810	0	Yes			
Glen Park	800	0				
Oakland West	391	176				

*Most station areas are surrounded by both minor (2-lane) and major (4-lane) streets. However, Union City and Fremont stations are not surrounded by residences as are other stations.

**Minimum for counts, 1-75.

- Richmond line station areas which will have direct service to San Francisco in the future. These station areas are:

  Richmond
  El Cerrito del Norte
  El Cerrito Plaza
  North Berkeley
  Ashby

  It is expected that if Transbay bus service is reduced in areas adjacent to the Richmond line when direct BART service begins (as it has on other lines), patronage at each station may double.

Moving Vehicle Accidents: Increases in moving vehicle conflicts have occurred and been attributed to BART where (a) traffic volumes have increased significantly near principal station exits or entrances, and (b) traffic controls either are not present or fail to operate effectively under increased traffic volumes. Significant accident changes were not found at stations with low patronage levels, but future accident increases can be expected in many station areas.

Approach: Station areas were divided into sites with potential for BART-related increases in moving vehicle accidents and sites where change is not likely. Sites with the greatest potential for accident increases were identified as places in medium or low density areas with high levels of BART patron autos. Station areas with low patronage appeared not to be experiencing BART-related changes in accidents.

Stations with potential for increases in moving vehicle accidents, and areas with no apparent potential, were divided into groups based on the likelihood of significant increases. Seven representative station areas were chosen and accident trends were studied in detail at these stations. Significant accident increases were found to occur at three of the seven sites: Daly City, Hayward, and del Norte. (In examining causes of accidents, the distribution of accident-influencing conditions were compared among station areas experienceing BART-related accidents and similar sites where effects were not apparent, but expected.)

In Table 4.4, site group representatives are listed with characteristics and expected accident changes.

TABLE 4.4
REPRESENTATIVE STATION AREAS BY IMPACT DETERMINANTS AND IMPACT POTENTIAL

	Impact Determinants				
Representative Station Areas	Parking Lot	BART-Induced Traffic (AM Peak Period) (Autos)	Background Traffic	Street Configuration	Impact Potential
Daly City	•	4,200	Medium-Low	Minor	Adverse Impacts Likely
Pleasant Hill	•	1,900	Medium-Low	Minor/Major	
Glen Park		1,100	Medium	Minor/Major	
Hayward	•	1,100	Medium	Minor/Major	
El Cerrito del Norte	•	950	Medium-Low	Minor/Major	
North Berkeley	•	300	Medium-Low	Minor/Major	No Impacts Likely
Oakland West	•	150	Medium-Low	Minor/Major	

Descriptions of Impacts at Primary Sites (Daly City, del Norte, Hayward):

Daly City: East of the south entrance/exit of the Daly City station in the vicinity of the Junipero Serra intersection, moving vehicle accidents other than those involving parked autos increased from two during the pre-BART study period (January through August 1973) to nine during a BART, pre-transbay period (January through August 1973). See the previous maps (Figures 4.3A and 4.3B) for locations of Daly City accidents. The Junipero Serra intersection is located west of the station's main entrance and exit and is the merging point for exiting and entering traffic.

Police spokesmen and patrolmen described this intersection as a problem area. Interviewed police personnel generally agreed that high BART-induced volumes had increased accident potential in this location.

Increases in reported accidents at this location are likely to be due to the following combination of factors:

- High BART-related auto and pedestrian volumes increases.

- Lane configuration of nearby streets.
- Insufficient metering of main BART station exit near the intersection. (The present stop sign is not sufficient to regulate the high traffic volumes.)
- Complex intersection.

This combination of accident influencing factors does not appear to occur at any other station but Daly City. The accident influencing factors are described below.

1. High BART-induced pedestrian and auto volumes increases -- as stated previously, Daly City had the highest auto traffic volume increases of any station and the greatest number of BART patron autos parked on nearby streets. From observation and an earlier parking study,[18] it appears that during the PM peak hour about 3,300 autos enter the intersection where accidents have increased as compared to 2,300 prior to BART. In addition, according to Conrad & Associates, over 900 persons cross John Daly Boulevard south of De Long and many cross in the southern crosswalk near the principal station entrance and exit during the PM peak period.[19] These pedestrian volumes are also greater than those found at other stations.

2. Street configuration -- the street configuration is such that most of the station traffic entering or exiting the main station entrance/exit and through traffic are required to make lane changes often in conflicting directions near the intersection.[20]

3. Insufficient regulation of principal station exit/entrance -- unlike most other stations with traffic volumes approaching that of Daly City, the main station entrance/exit near the Junipero Serra intersection is controlled by a stop sign in only one direction. Because of this, during peak periods, traffic is highly congested near the Junipero Serra intersection.[21]

---

[18]Conrad & Associates, "Daly City Fringe Parking Study," (September 1974); for BARTD.

[19]4:15 PM to 6:00 PM.

[20]These assertions are based on PM peak period observation from 4:00 PM to 6:00 PM on a typical weekday.

[21]These assertions are based on PM peak period observation from 4:00 PM to 6:00 PM on a typical weekday.

4. Intersection complexity -- finally, persons who do enter the Junipero Serra intersection enter a complex system of merging streets (six-way) with a signal system which, according to a police spokesman, is confusing and has been the cause of accidents. Off-peak drivers encounter only the complex intersection and confusing signal system.

   With the exception of timing adjustments, the signal system has not been changed since prior to BART. In addition, within about 200 feet of the intersection there have been no street widenings, although John Daly Boulevard[22] was widened to the east of the intersection.

El Cerrito del Norte: Significant accident increases also occurred between pre-BART and BART study periods at two locations near the El Cerrito del Norte station. From February through December 1972, there were no accidents reported near or at intersections one block south or one block north of the station. However, during this same period in 1973 (BART began operations January 24, 1973), there were three accidents in the south location and six accidents in the north area. During a comparable 1974 period there were six accidents in the south area and seven at the north location. Chance occurrence of such differences is extremely unlikely.

At del Norte, residents appear to have reacted to the inconvenience of one-way streets by choosing to use adjacent two-way collector streets which are not signalized where they intersect a major arterial. According to police and public officials, it is likely that the increased traffic on the unregulated streets is contributing to accident increases.

Hayward: Accidents were also found to have increased steadily on streets adjacent to (a) the main downtown Hayward station entrance, and (b) the main exit/entrance of the west parking lot. See Figures 4.2 and 4.3 for comparisons of pre-BART and BART traffic accidents and traffic volumes increases.

During September through December 1973 (pre-Transbay study period), three moving vehicle accidents were reported in an area north of the station while from September to December 1974 (Transbay study period), 13 accidents were recorded in the same vicinity. Most of the accidents occurred during peak periods when BART-induced volumes are highest. Public and police officials appeared to be aware of a problem in this area but not of its magnitude. They are studying the need for

---

[22]Formerly Knowles.

HAYWARD: BART, PRE-TRANSBAY TO BART, TRANSBAY:
TRAFFIC VOLUMES AND ACCIDENT INCREASES

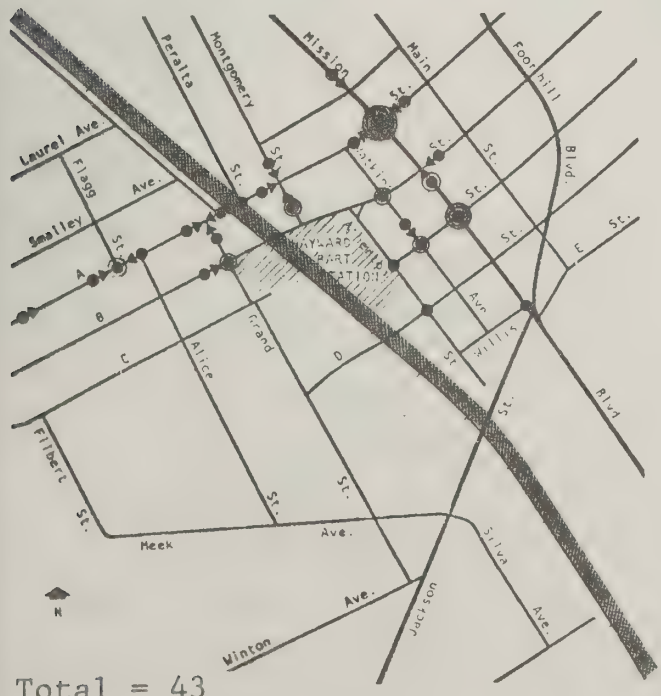
FIGURE 4.2A
ADT TRAFFIC VOLUME INCREASE
(1973-1974,1975)

FIGURE 4.2B
ACCIDENTS (SEPTEMBER THRU DECEMBER
1973)

Total = 23

Weekdays
6:00 AM - 8:00 PM

FIGURE 4.2C
ACCIDENTS (SEPTEMBER THRU DECEMBER
1974)



Total = 43

Weekdays
6:00 AM - 8:00 PM

Legend

(xxx)	Average Daily Traffic Volume Increase
xx%	Percent Average Daily Traffic Increase
•	One Accident
○	Each Additional Accident
▶	Direction of Nearest Intersection
	BART

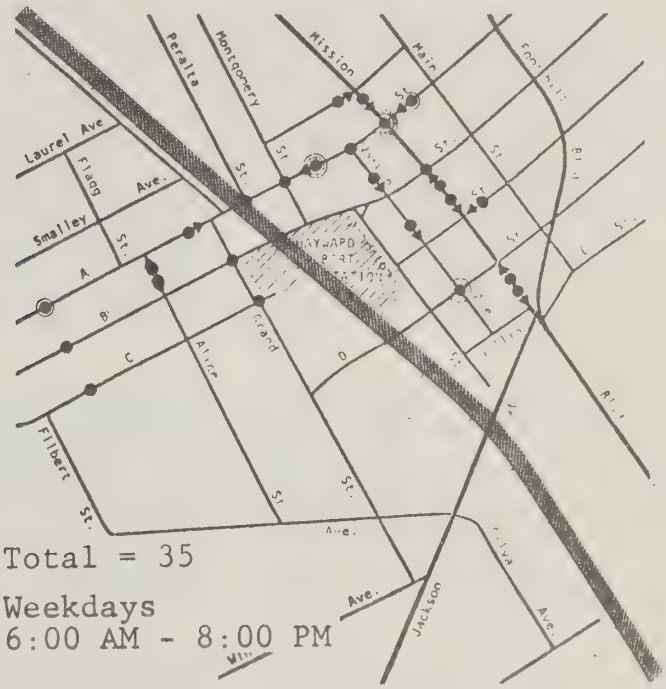
HAYWARD: PRE-BART TO BART, PRE-TRANSBAY:
TRAFFIC VOLUMES AND ACCIDENT INCREASES

FIGURE 4.3A
ADT TRAFFIC VOLUMES INCREASES
(1972-1973)

Legend

(xxx)	Average Daily Traffic Volume Increase
xx%	Percent Average Daily Traffic Increase
•	One Accident
○	Each Additional Accident
▶	Direction of Nearest Intersection
▒▒▒	BART

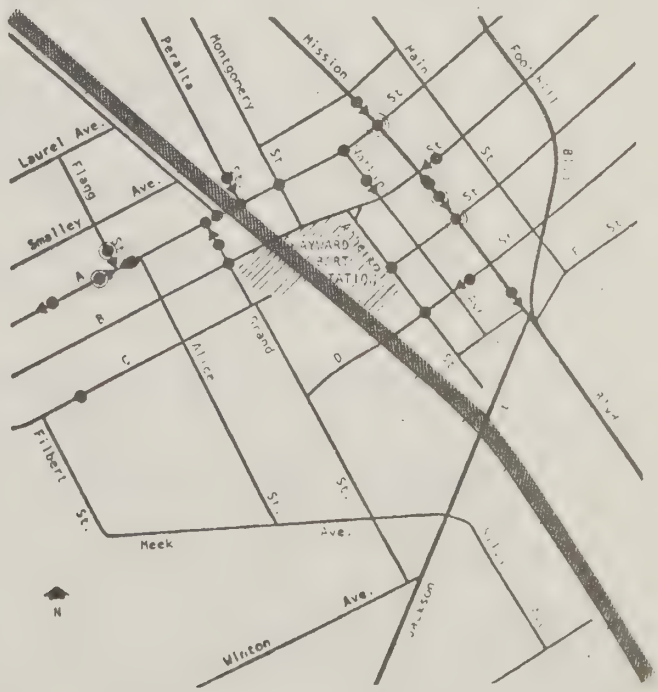
FIGURE 4.3B
ACCIDENTS (JANUARY THRU AUGUST 1972)



Total = 35

Weekdays
6:00 AM - 8:00 PM

FIGURE 4.3C
ACCIDENTS (JANUARY THRU AUGUST 1973)



Total = 33

Weekdays
6:00 AM - 8:00 PM

placement of a traffic signal at one of the accident locations but no other controls are planned.

Primary Site Comparison, Hayward Versus El Cerrito del Norte and Pleasant Hill: Traffic accident increases at Hayward which appear to be due to increased BART patron traffic volumes were not found at the Pleasant Hill and del Norte stations. (The Pleasant Hill station has somewhat higher BART-induced traffic volumes than Hayward while del Norte's are slightly lower than are Hayward's.) However, in areas where traffic has increased most significantly near the Hayward station, traffic controls have not been added. Existing traffic controls at the Hayward station appear to be insufficient to regulate the increased volumes properly.

The previous figures show the streets where traffic increases near the Hayward station are most significant and, since other traffic has generally been declining in the area, it appears that increased volumes are due to BART patron traffic. As shown on the maps, volume increases appear to be most significant on Grand, on B Street near Montgomery, and on A Street, the same locations where accident increases were reported.

Although traffic volumes have increased, traffic controls have not changed. Turn movements which appear not to be regulated sufficiently are listed below and numbered on the accompanying map:

1. Autos turning into main station entrance off Montgomery and B Street.

   Regulation: None except a stop sign regulating southbound Montgomery Street traffic.

2. Left turn movements between Grand and B Streets.

   Regulation: A signal without provision for left turns. However, there is channelization on the B Street approaches.

3. Turning movements of A Street traffic desiring to travel south to the BART station.

   Regulation: None except a signal at the A Street/ Montgomery intersection.

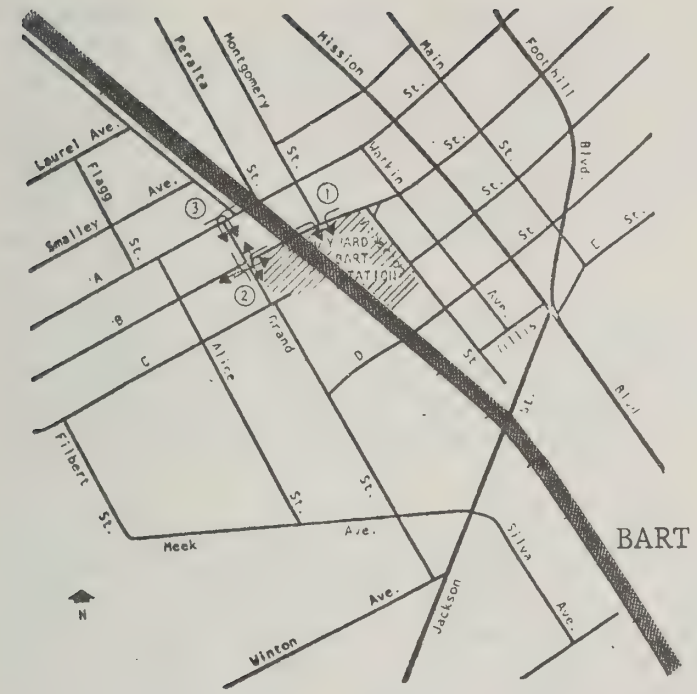


FIGURE 4.4
HAYWARD AREAS JUDGED TO HAVE REGULATION INSUFFICIENT FOR PRESENT TURN MOVEMENTS

Legend

○ Accident Locations Described In Text

→ Direction of Travel

Unlike Hayward, BART traffic at the Pleasant Hill and del Norte stations is metered in and out of the flow of background traffic by the use of signals. At Pleasant Hill, most of the traffic from the station's parking lot and drop off/pick up facility exits and enters one-way station access roads which connect with a heavily traveled four-lane street where signals and channelization regulate the flow of traffic. At the del Norte station, most of the BART parking lot traffic is also queued onto two one-way streets. There are signals with left turn arrows and channelization where the one-way streets intersect a major arterial.

No Impacts, Other Primary Sites: At representative sites other than Daly City, del Norte and Hayward, no significant accident increases were found although increases were expected at Glen Park and Pleasant Hill.

Pleasant Hill and Glen Park: Accident increases were expected at Pleasant Hill because of the area's high patron traffic and generally minor road system. Increases were expected at Glen Park because of medium patron auto and background traffic levels and the many BART patrons walking to and from parked autos (Glen Park has no parking lot).

In Pleasant Hill, comparing a pre-BART study period (September 1972 through December 1972) to a BART pre-Transbay period

(September 1973 through December 1973), accidents during BART operating hours decreased from seven to five. From the BART, pre-Transbay study period to a BART Transbay period (September 1974 through December 1974), accident change was again insignificant (from five to seven reported accidents). County public officials stated that although the station area was more congested than prior to BART, accidents had not significantly increased.

However, trained observers and county officials noted a high accident potential caused by the high mix of autos, pedestrians and bikes in the station area, and the presence of a narrow country road opposite the station which brings traffic to the station and to a major arterial.

At Glen Park, accidents did not increase significantly from a period immediately prior to BART to a BART, pre-Transbay period. During the pre-BART study period (January 1973 through August 1973), 18 accidents were reported within two to three blocks of the station while during the BART, pre-Transbay study period (January 1974 through August 1974), 20 accidents were reported during BART's operating hours.

Pedestrian versus vehicle accidents appear not to be occurring because:

- Pedestrians have three walkways with which to exit the station.
- The sidewalk storage capacity near the station appears to be sufficient. Pedestrians are not standing in streets waiting to either cross or get to cars waiting to pick them up.
- The intersections with the greatest pedestrian and vehicle traffic flows are signalized and others have walk signs.

North Berkeley and Oakland West: At the sites with low patronage where accident trends were studied (Oakland West and North Berkeley), no significant changes in moving vehicle accidents were found. Public and BART officials and police spokesmen from both local jurisdictions stated that accident increases were not occurring at either location.

It appears that the lack of change is due to BART traffic generally not contributing significantly to increased volumes and not taxing the street system. Berkeley public officials stated that the regulatory capabilities of a BART-induced traffic diverter and signal installation are not being tested by current BART-induced traffic levels. At Oakland West, the street system does not appear to be taxed although, during the AM peak period, Post Office employees riding BART are required to cross an unregulated intersection.[23]

Another characteristic of most low patronage stations, which probably contributes to no change in accidents, is generally low peaking with peak period exit patronage either equal to or less than midday exit patronage. This occurs at North Berkeley but not at the West Oakland station.

Generalization to All Suburban Sites: Interviewed public officials and police spokesmen at stations other than selected study sites generally stated that they had no evidence that BART was causing significant accident changes. However, in most areas, formal studies of accident trends on streets near stations had not been made.

Four exceptions were found. All four areas had medium to high levels of BART-induced traffic and, as in Hayward, present traffic controls are not operating effectively to control the increased volumes. Accident increases attributed to BART were found in only seven of 25 suburban station areas, but it appears that the potential for future accidents is more widespread. Discussion focuses first on BART-related accident increases found at other than primary sites and then upon future propensity for increases in BART-related accidents at all stations.

Other Impact Areas:

- Fremont: At an intersection adjacent to the Fremont station (the station with the fourth highest patronage in the system), a four-way stop system is being replaced by a signal because the stop signs, according to police officials, are not adequately controlling the high level of BART patron traffic and accidents which are occurring.

- Union City: A police spokesman stated that the area immediately adjacent to the station is congested but not traffic-controlled. In addition, police have been asked repeatedly to direct peak period traffic near the station although they do not have the required personnel.

---

[23]There are twice the number of exit patrons during the AM peak period than at any other time of day.

- San Leandro: Pedestrians have been crossing major streets at three locations. At one intersection there is no stoplight and in the other two locations BART patrons and employees at a nearby plant are jaywalking. There have been increases in the numbers of accidents at these locations, according to public officials, which have been attributed to BART patronage traffic.

- South Hayward: Accidents increased significantly in 1973 when a road segment (Dixon Road) was extended for use by BART patrons. However, during 1974, the number of accidents was less than half that of the previous year. Consequently, it is assumed to have been either a temporary situation or one in which probability of future occurrence is low.

Propensity for Future BART-related Accident Increases: Inferences about the likelihood of future accident occurrence that can be made from representative site findings are discussed below.

Daly City: Although significant accident increases (otner than accidents involving parked cars) were found in only one location near this station, it appears that the occurrence of more accidents is likely, particularly if patron traffic volumes increase with the planned construction of a parking structure.[24] Conrad & Associates made several recommendations for traffic control facilities changes around the Daly City station. The traffic problems mentioned in their report are summarized below:

- The potential for pedestrian/auto conflicts is high where pedestrian crosswalks are located near the principal exit/entrance. Drivers merging into background traffic often did not watch for pedestrians crossing in front of them. Conrad & Associates suggested that the crosswalk where this problem occurs be removed. In one location, sidewalks were so narrow as to force peak period pedestrians to walk in the street.

- High peak period bus volumes (about 12 per peak hour), when mixed with high patron pedestrian and auto volumes, contribute to a hazardous situation near the main station exit/entrance. Buses are subjected to merging into background traffic at this uncontrolled intersection. Buses also are required to make a narrow U-turn to enter either of two principal station entrances. In congested traffic, this maneuvering is difficult for bus drivers and hazardous to auto drivers proceeding through the area.

[24]According to Conrad & Associates ultimately 73 buses per peak hour are planned to arrive at the station.

In addition, in response to citizen complaints about parked autos, police assistant trainees and a meterman have been hired to ticket illegally parked autos.

Pleasant Hill Group: Peak period congestion is also occurring at all stations in the high BART-induced traffic volumes stations group represented by Pleasant Hill (Concord, Walnut Creek, Lafayette, Orinda, Fremont). However, with the exception of Fremont, accident increases were not significant enough to warrant immediate actions being taken to regulate traffic flows further.

Long term changes in street configurations, traffic control and increased parking facilities have been suggested at all stations. County officials in the Pleasant Hill area have proposed a street extension and widening of a country road; Walnut Creek officials are planning to make changes to separate access of different modes; Concord has been continually implementing street improvements in areas adjacent to the station. Bike lanes are also planned for the Concord and Pleasant Hill stations. Carpooling has been encouraged at the Orinda and Lafayette stations to decrease the number of patron autos, and at Lafayette the city bought land from the state for additional parking.

Bus traffic has increased significantly in areas adjacent to stations as feeder bus service has been added to serve BART. Increases have been most significant at the Concord and Walnut Creek stations,[25] but apparently the incidence of accidents involving buses has not changed. However, residents of San Ramon, an outlying community served by the Walnut Creek feeder bus service, made several complaints to public officials about reduced safety they assumed would result from buses traveling on residential streets.[26]

It is expected that outlying development which has occurred near all but the Orinda station will continue and increase traffic volumes near stations. Stations adjacent to freeways will likely be most affected (Pleasant Hill, Walnut Creek, Lafayette).

Glen Park Group: Accidents attributed to BART do not appear to have occurred at either Glen Park or Balboa Park. As stated earlier, accident increases were not found at Glen Park because of the pedestrian amenities which

---

[25]Concord: Zero to four BART station bus arrivals per average peak hour; Walnut Creek: Four to 11 BART station bus arrivals per average peak hour.

[26]Pleasanton Times, November 10, 1974.

are also present at Balboa Park. Less severe accident increases were expected at Balboa Park because there are about half the BART pedestrians (not including persons walking to cars) here as in Glen Park and slightly less auto traffic. If BART-induced traffic increases significantly, the two station areas in this group may be adversely affected.

Hayward Group: Three out of four areas in this group of medium density, mixed land use, medium to high BART patronage stations have experienced BART-related accident increases. The accident problems are described above.

The only station that has experienced no problems is Fruitvale. Similar to the del Norte and Pleasant Hill situations, a system of traffic controls was added to streets adjacent to the Fruitvale station and it appears to be regulating present traffic properly. According to Oakland officials, BART traffic does not add significantly to the traffic on the major streets surrounding the Fruitvale station. However, if patronage increases, it is expected that the signal system may not be sufficient.

Continuing development in the Union City station area will probably reduce safety. Patronage is expected to increase and so is background traffic.

Del Norte Group: Significant accident increases were noted at three of the four sites in this group of stations with medium to medium-high BART-induced traffic in commercial/residential areas. Accident increases were found and attributed to BART in del Norte and South Hayward, while increases in the Bayfair area were apparently caused by population growth. El Cerrito Plaza, the area with the lowest patronage and auto traffic of any station area in the group (about one-third the patronage of del Norte and one-half the auto traffic of the representative site), showed no evidence of accident increases. This is probably due to the fact that station traffic volumes are low. If development continues near the Bayfair station in the Ashland area, it is likely that the number of BART patrons and background traffic will increase significantly. In addition, the two El Cerrito stations are likely to experience a doubling in patronage when direct Transbay service commences if Transbay bus service is reduced. Plans are already being made to add traffic control facilities to regulate additional traffic.

North Berkeley and West Oakland Groups: No accident changes attributed to BART were found at any of the low patronage stations in these groups. In fact, at one station (Ashby), local officials are considering removing a signal near the station's entrance since it has been found that traffic volumes do not warrant signal operation. As stated previously, no change

in accidents is likely because of low patronage and no significant peaking of patron traffic volumes at all stations except Oakland West. At all of these stations, peak period patronage would have to at least double (with or without additional traffic producing development of land use) before stations encounter the problems of sites in other groups. This doubling may occur at the stations on the Richmond line when direct Transbay service commences if Transbay bus service is reduced as it has been on the Fremont line.

Summary: In summary, it appears that although accident increases have occurred and been attributed to BART at only seven of 25 suburban stations, future accident increases due to development and/or BART operations increases may occur at about 13 stations. In Table 4.5, present accident-influencing conditions, BART-related increased accidents, future conditions and propensity for potential future accident increases are shown by station area.

TABLE 4.5
POTENTIAL MOVING VEHICLE ACCIDENT INCREASES

	Present Conditions			Future Conditions			
	Background Traffic Levels	BART Auto Traffic	BART-related Accident Increases	Traffic Control Facilities Proposed or being Implemented	Propensity for Future Population Growth or Development	BART Operations Increases**	Resulting Propensity for Potential Future Accident Increases
Daly City	M(Medium)	H(High)	●	●		●	●
Pleasant Hill	M-L	H		●	●		●
Concord	M-L	H		●	●		●
Walnut Creek	M-L	H		●	●		●
Lafayette	M-L	M		●	●		
Orinda	M-L	M		●			
Fremont	L(Low)	H	●	●	●		●
Glen Park	M	M					
Balboa Park	M	M			●		●
Hayward	M	M	●	●			
Fruitvale	M	M					
San Leandro	M	M	●	●			
Union City	M-L	M	●		●		●
del Norte	M	M	●	●*			Not Known
Bayfair	M-L	M			●		●
El Cerrito Plaza	M	L		●*			Not Known
So. Hayward	M-L	M	●	●			
North Berkeley	M	L					●
Rockridge	M	L					
West Oakland	M	L					
Lake Merritt	M	L					
Richmond	M-L	L			●	●	●
Ashby	M	L				●	●
Coliseum	M	L					
MacArthur	M	L					

*Proposed in anticipation of increased patronage when direct Transbay service commences.
**Includes planned feeder bus increases.

Parking Lot Accidents: Although the number of reported parking lot accidents has generally been insignificant, there are conditions which appear to create high accident potential. These conditions are high mixing of pedestrian, auto and bus volumes in some parking lots and systemwide signing problems.

Approach: Parking lot accident trends for the last four months of 1974 (Transbay service) were studied for all station areas with parking lots. Parking lot accident potential was determined by brief midday or peak period observations at all suburban parking lots, study of aerial photographs and site plans, and in-depth interviews with BART police officials and patrolmen. Standard traffic engineering practice was also used as a reference for the evaluation.

Accident Distribution: During 1974 Transbay service, less than six traffic accidents were reported at each of 18 stations while six other stations had no reported accidents. Most of the accidents reported were moving vehicle versus moving vehicle accidents. Table 4.6 is a listing of accidents by station and type. BART police spokesmen attributed the generally low accident rate to low speeds in the lots. (There is a 15 mile per hour speed limit in station parking lots.)

Mode Mix: Where the same lot areas are used as pedestrian crossings, bus stops and drop off/pick up areas, high volumes contribute to accident potential in several station parking lots.

Bus stops and pedestrian crosswalks were designed to give bus riders and walkers direct access to station entrances. However, at most stations, drop off/pick up areas were designed to be a separate activity adjacent to, but not directly in front of, station entrances. These areas were planned for use by drop off/pick up autos during peak hours and for midday and other off-peak parking.

According to interviewed BART officials, however, such areas are generally not used for these purposes, but by all day parkers. Pick ups and drop offs tend to occur in front of station entrances where patrons have more direct station access.[27] Thus, at many stations, there is a high mixing of different modes in front of station entrances. Presently, BART is not enforcing parking restrictions in these areas, but there are plans to begin enforcement after sign changes are made.

---

[27] Source: Observation of PM peak period traffic flow at selected suburban sites and atatements by police officials.

TABLE 4.6
PARKING LOT ACCIDENTS BY STATION AND TYPE
(SEPTEMBER THRU DECEMBER 1974)

	Accident Type			
Station Area	V/V	V/	V/Ped	V/Other
Concord	3	1		
Pleasant Hill	2			
Walnut Creek	3			
Rockridge	1			
Richmond	1			
El Cerrito del Norte*				
El Cerrito Plaza	2		1	
North Berkeley		1		
Fremont	2			
Union City	1			
South Hayward	1			
Hayward	1		1	
Bay Fair	4	2		
San Leandro	2			
Coliseum	5			
Fruitvale		1	1	2
Lake Merritt	1			
Daly City	4			

v/v = Moving vehicle versus moving vehicle
v/ = Single vehicle
v/ped = Vehicle versus pedestrian
v/other = Vehicle versus other mode (e.g., bus)

* El Cerrito del Norte was the only station with no reported accidents.

Below, pedestrian versus auto and bus versus other mode conflict potential (resulting from different modes traversing the same locations) are discussed.

1. Pedestrian Versus Auto Conflict Potential:

- Pedestrian and Drop Off Auto Access Not Separated. Potential for accidents involving pedestrians and autos appear to be highest at stations with high patronage levels, and pedestrian and drop off areas not separated or only partially separated. At most stations with lots, pedestrians cross parking and drop off/pick up traffic in front of station entrances. At almost half of the suburban stations with parking lots, all pedestrians proceeding to or from station entrances have no choice but to cross the drop off/pick up areas. These stations have drop off areas and lots on both sides of the stations (Daly City, Pleasant Hill, del Norte, El Cerrito Plaza, Richmond) or

single lots on one side of the stations (Coliseum, MacArthur, South Hayward, and Union City). It is likely that conflict potential is highest where there are the most patrons in the lots, i.e., Daly City, Pleasant Hill, Union City and South Hayward.

- Separate Pedestrian and Drop Off Auto Access. At three stations where drop off areas are separated from other mode use areas, the chances of conflict between pedestrians and autos are likely not to be as high. At the Lafayette, North Berkeley and Rockridge[28] stations there are separate streets and stopping areas for drop offs. BART police officials stated that the North Berkeley station has one of the best parking lot layouts on the system for access and egress because the drop off area is separated from all-day parking. However, at Lafayette and Rockridge stations, in addition to the separated drop off areas mentioned, there are areas being used for drop offs which are in front of station entrances.

- Partially Separated Pedestrian and Drop Off Auto Access. At all other suburban stations with parking lots, the stations have lots on two station sides and drop offs are made on only one side. At these stations, pedestrians coming from the sides of stations without drop off areas generally only encounter parking autos.

- Major Street Divisions Between Parking Lots. Also, where lots are split by major streets and there are no separated pedestrian walkways, potential vehicle/pedestrian conflicts appear to be higher than where major streets do not divide lots. At Fruitvale, Rockridge, del Norte, and Lake Merritt stations, major streets separate the lots.[29]

  At all stations except del Norte, these streets are two-way. It is probable that the one-way streets at del Norte cut accident potential. The problem seems to be greatest at Fruitvale. There are greater distances between pedestrians and traffic controls at this station than in other areas. Also, Fruit-

---

[28]At Rockridge, the separate drop off area is also used for handicapped parking.

[29]The street dividing the del Norte lot appears to have less traffic than do the dividing streets at other lots.

vale has more patrons and thus more chance for conflict than either Rockridge or Lake Merritt.

2. Locations of High Conflict Potential: It has been estimated that conflict potentials were generally highest among high patronage stations and lowest among low patronage stations. Table 4.7 shows, by station, two lot conditions that tend to accentuate conflict potential: all pedestrians mixing with all drop off autos and division of lots by major streets. It also shows a condition that tends to reduce conflict potential: separated drop off areas. In addition, there are estimates of the three volumes that contribute to conflicts at each station: the number of pick up autos and walkers during the PM peak period, and the maximum numbers of parking lot autos.

   From these volumes estimates and knowledge of parking lot conditions, numbers of potential conflicts were derived with the following assumptions:

   - Estimates could be derived by multiplying the number of PM peak pick up autos by PM peak walkers by numbers of lot autos for stations with all walkers crossing drop off areas.

   - Estimates could be made by multiplying one-half the number of pick up autos times walkers times parking lot autos for stations with lots on either station side and drop off areas on one side.

   - For the two stations with divided lot and drop off access, estimates were derived by multiplying one-half the drop off autos by the other two variables. Estimates for the one station with a separated drop off area were based on the product of walker and parked auto volumes.

   - No penalties were assigned to stations with major streets dividing lots although this contributes to conflict potential.

   In deriving all of these estimates, the underlying assumption was that conflict potential is based on the premise that potentially every vehicle or person can conflict with every other person or vehicle in the same location. Conflict potential was then ranked by station and the ranks are shown in Table 4.7.

TABLE 4.7
PARKING LOT ACCIDENTS: POTENTIAL CONFLICT RANKING BY STATION

Station	CONFLICT RANK DETERMINANTS: All Pedestrians Vs. Drop Off Autos	Separated Drop Off Areas	Lots Divided by Major Streets	Number of Pick Up Autos (PM Peak Period)	Pedestrians, Persons Walking to Cars	Number of Parking Lot Autos	Conflict Rank (1=highest potential)	Ranked Patronage Levels (PM) Peak Period)
Concord				500	1,400	1,059	3	2
Pleasant Hill	●			350	1,500	1,337	2	5
Walnut Creek				400	1,500	1,114	4	3
Lafayette		●		250	1,000	650	10	8
Orinda				200	800	773	11	13
Rockridge		●	●	150	500	629	16	15
Fremont				400	1,500	700	5	4
Union City	●			200	900	810	7	10
So. Hayward	●			200	550	501	12	16
Hayward				250	800	861	9	7
Bayfair				240	1,100	1,408	6	6
San Leandro				150	700	841	13	12
Fruitvale			●	200	600	730	13	11
Coliseum	●			50	250	185	21	19
Lake Merritt			●	150	300	240	20	21
Richmond	●			100	350	322	19	20
del Norte	●		●	150	950	847	8	9
El Cerrito Plaza	●			100	550	418	16	17
North Berkeley		●		50	450	370	22	18
Ashby				50	300	208	18	22
MacArthur	●			150	450	450	15	14
Oakland West				50	300	251	22	23
Daly City	●*			1,100	3,300	820	1	1

*However, observers noted that most drop offs occur on one side of the station.

3. Bus Versus Auto and Pedestrian Conflict Potential: Where bus traffic mixes with pedestrian and drop off traffic, at about two-thirds of the suburban stations with lots, conflict potential is generally high.

- Bus and Other Mode Access Not Separated. At most stations where this occurs, buses stop in front of station entrances, while at others buses stop opposite station entrances and patrons are required to cross traffic. Bus riders have to cross station lots through traffic, including "drop off" traffic at Walnut Creek, North Berkeley, San Leandro and South Hayward stations.

- Separate Bus and Other Mode Access. At seven of the stations (Ashby, Concord, Rockridge, Oakland West, Lake Merritt, MacArthur and Coliseum), potential conflicts between buses and other modes are generally low. At these stations buses do not enter parking lots, but stop outside of stations. At two stations (Ashby and Coliseum) patrons have direct access to stations without having to cross any traffic. Where buses do not enter lots but pedestrians are required to cross parking lots or

major streets, possibilities of pedestrian conflicts with background or parking lot traffic are significant. (This situation exists near one bus stop at Rockridge, Oakland West, Lake Merritt, and MacArthur. Also at Rockridge, buses stopping across the street from the station compete for space with drop off/pick up autos.)

- Bus Double Parking. Double parking of buses during peak periods appears to be posing a hazard at Bayfair and Fremont stations. The number of assigned spaces for buses is insufficient at these two stations, both of which have medium to high patronage levels.

4. Locations of High Conflict Potential: Of the stations where buses enter lots and stop near station entrances, conflicts are more likely to occur where bus, drop off and lot-parked auto volumes are high (see Table 4.8). Bus versus other mode conflict potential is probably most significant where mode volumes are high and buses stop across from station entrances in lots. This occurs at the Walnut Creek and San Leandro stations.

TABLE 4.8
STATIONS WITH HIGHEST BUS/
OTHER MODE CONFLICT POTENTIAL

	DETERMINANTS			
Station	Pedestrians in Lot[d]	Auto Lot Use	Bus Traffic[b]	Drop Off/[c] Pick Up Autos
Bayfair	1,100	1,000	21	250
San Leandro	700	465	25	150
Daly City	3,300	800[a]	11	1,100
Walnut Creek	1,500	1,100[a]	11	400
Hayward	800	800[a]	27	250
del Norte	950	800	24	150
Fremont	1,500	700[a]	16	400

a. Daily maximum use (January 1975)
b. Typical peak hour
c. PM peak period, 3:45 - 6:00 PM
d. PM peak period, persons walking to autos or walk mode

5. Pedestrian Crosswalks: Generally well marked pedestrian crossings in most station parking lots seem to be contributing to safety. From on-site and aerial photo studies, it is clear that pedestrian crossings are usually well marked with either bands of white lines or changes in pavement color.

Signing: Within the parking lots, signing and marking is generally inadequate and inconsistent.

Signing in BART lots does not presently meet state or federal signing regulations. Signs installed at the stations are generally smaller and less visible than are regulation signs (see Figure 4.11). On many signs the letters and symbols are smaller than those of regulation signs. In addition, because of the difference in symbols, it is likely that some signs are not automatically recognized by drivers. At present, according to a BART police official, no more of the non-regulation signs have been ordered, and it is planned to replace them. *

FIGURE 4.3
BART, STATE AND FEDERAL SIGNS

BART	State of California	Federal
 14" x 28"	 24" x 30"	 24" x 30"
 14" x 28"	 24" x 24"	 24" x 24"
 14" x 26"	 36" x 36" x 36"	 36" x 36" x 36"

* Since the time that this report was drafted, in mid-1975, the program of replacement has been started.

The following signing problems were also noted:

- No Directions to Special Parking Spaces. No provision has been made to direct special parkers, such as handicapped persons, motorcyclists, or cyclists, to their spaces.

  In "BART and the Handicapped," the following statement was made about handicapped parking spaces: "While they are well located, they are not always well marked. Small vertical signs with the handicapped symbol are placed by the spaces in some stations, which is helpful, as the parking lots are often extensive and a considerable amount of circling is necessary to locate the spaces."[30]

  In addition, the midday parking area signs are not very visible, because of their size. The signs and pavement markings do not clearly define the bounds of these parking areas and there are no directions at station entrances leading patrons to these areas. At the Hayward station, which does not appear to be atypical, observers had difficulty identifying the bounds of the midday parking spaces. At Daly City, as well as at Hayward, it was noted that during the PM peak period when the station was congested with pick up traffic, many of the spaces available for pick up were not being used.

- Inconsistencies in Sign Placement. As examples: at Bayfair station, a lot intersection "YIELD" written on the pavement was accompanied by stop signs; at El Cerrito Plaza station, a "DO NOT ENTER" sign was mistakenly placed at the main entrance; at the Pleasant Hill and Bayfair stations, "ONE WAY" arrow signs and "NO TURN" signs were missing where one-way streets intersected two-way adjacent streets. It was also noted at Pleasant Hill that pedestrian crosswalk markings and signing were not consistent.

- Red Zones. When BART opened, no red zones were marked except in places for bus drop off and pick up. Hence, at stations where lots were filled to capacity, autos parked at the ends of islands and near curbs often blocked traffic. According to interviewed BART police spokesmen, this posed a hazard. Curbs around islands

[30]Robert Levine, Metropolitan Transportation Commission, Page 40.

and near station boundaries have since been painted red but enforcement of red zones is infrequent.[31]

- Station Entrances Not Clearly Marked. Although there are BART signs placed near parking lots, there are no signs saying "ENTRANCE". Observers unfamiliar with lot configurations noted that this lack of parking lot entrance signing led them to experience driver uncertainty.

- Sign Posts and Lighting Standard Placement. Sign posts and lighting standards tend to be placed in the middle of sidewalks. Ideal design would have placed these obstructions outside of pedestrian travelway, allowing pedestrians freedom of movement.

- Bike Travel Accomodations. At stations where there are about 100 peak period cyclists or more during temperate weather, Concord, Pleasant Hill and Walnut Creek, no accommodations have been made in lots to separate bike travel from other mode travel. According to BART police spokesmen, because of restricted lot spaces, there are no plans to accommodate bike travelers.

Non-Traffic Safety

Generally, BART has had no significant effects on non-traffic safety in line areas or station areas.

Approach: Further interviews were conducted, particularly with BART police officials. Trends of reported trespassing incidents were studied and line areas were inspected for ease of trespassing activity (e.g., cut fences). In addition, effects of pedestrian grade separations constructed where BART track runs parallel to railroad lines were studied.

Trespassing: According to BART police spokesmen, trespassing at both line and station areas has generally not been a problem. Analysis of crime reports showed that only five incidents of trespassing were reported during 1974 Transbay service. Only one reported incident was on the trackway (Fremont line) while four incidents occurred at stations (MacArthur, Concord, 16th/Mission, North Berkeley).[32]

---

[31] It was observed at the Pleasant Hill station where the lot is filled beyond capacity that red curbs were ignored by motorists, particularly near the station's main exit. These parked autos made passage for moving autos hazardous.

[32] "Bay Area Rapid Transit District - Police Services Department, Report of Offenses and Miscellaneous Reports", September through December, 1974

Trespassing has been considered a problem at only two on-grade line areas where barriers did not exist prior to BART and residences with many juveniles are next to the right-of-way. School children have cut fences near the Hayward station to cross on-grade track and in Richmond prior to any BART action, on-grade fences near the local YMCA and community park were cut 14 times.[33] The Hayward fence cutting was stopped by repairing the fence. In Richmond, BART police met with neighborhood members and it was decided to construct an overpass near the area where fences had been cut.

At both Richmond and Hayward, BART officials stated that fences were cut by juveniles living in areas adjacent to trackway.

BART made early plans to prevent trespassing from becoming a problem and has continued to monitor the incidence of trespassing. However, most of the early plans for a physical security and safety program have not been implemented.

Prior to the commencement of BART operations, BART hired a consultant firm[34] to work with BART police to document the more serious physical security problems associated with BART facilities and right-of-way, and to recommend changes. This survey involved consideration of hazards which could result from trespassing as well as building security. Sixteen locations were identified as problem areas and most of the problems identified were those near on-grade or aerial stations. Two locations were near track transition areas and one was at on-grade right-of-way. Problems identified most often were:

- Fencing or grille work not sufficiently high or low to prevent climbing over or under and consequent entry to station and/or trackway.

- Low walls surrounding aerial structures which do not prevent climbing onto trackway.

Barbed wire has been added to fences in some locations to prevent crossing. Most of the recommendations have not been implemented although police services have suggested the changes to be made.

BART police collect and classify separately all trespassing reports. In addition, BART police periodically patrol line areas.

---

[33] Fences were cut in the area between 2923 and 3005, Ohio.

[34] Arthur Young & Company, Security Surveys, October-November, 1972.

Other Non-Traffic Safety Problems: According to interviewed BART officials, there are no other significant non-traffic safety problems at line or station study areas. BART has generally increased safety by the design of pedestrian and railroad separations in the Hayward and Concord areas as well as in Richmond. Between Hayward and the South Hayward stations, two pedestrian overpasses crossing over BART and other railroad tracks were designed by BART and built by the City of Hayward. The southernmost overpass was built in an area with schools on both sides of the BART line. On the Concord line between Concord and Pleasant Hill stations, a pedestrian overpass to the Oak Grove school was constructed.

V. SECURITY

DEFINITION AND SCOPE

The study of BART's security impacts encompassed identification of changes in the occurrence of crime and crime-related activities attributable to BART in areas adjacent to BART stations, including parking lots, and along the BART line. A change or difference was regarded as appreciable (or significant) when more than one informed source yielded credible evidence of differences or changes regarded as meaningful within the local context. This amounted to a process of triangulation, or verification through complementary sources. Evidence included opinions of official police spokesmen, patrolmen's reports, citizen's reports, crime statistics, and direct observation by trained study staff.

The station locations included for study were station plazas[1] and parking lots as well as nearby streets and neighborhoods. Crime activities were studied in station plazas and parking lots, despite their status as elements of BART, rather than surrounding environment because crime in these areas may affect surrounding communities. It is sometimes hypothesized that parking lots or plazas are initial attractors to criminals who then proceed to commit crimes in surrounding areas. Streets and neighborhoods from one to three blocks from stations were studied depending on population density, land use similarities, and aggregations of available data. Generally, boundaries were wider in low density suburban areas than in high density city center areas.

BART line areas are all the areas along the BART right-of-way between stations including BART property (whether intended as inaccessible or not) and adjacent streets and properties. Adjacent areas studied were generally within one block of the line, based on the assumption that most BART-related criminal activity would occur within this range.

BART linear parks were studied as separate line types because of their uniqueness. They were designed to demonstrate that areas beneath aerial trackways can be aesthetically pleasing community assets. The El Cerrito and Albany linear parks include walkways with extensive landscaping on a 2.7-mile-long narrow right-of-way beneath an aerial portion of the trackway. In Concord, a 1/2-mile section of aerial line on a wider, minimally improved right-of-way can also be termed a linear park, although less formally so.

---

[1] Including the Richmond station pedestrian mall.

This research focused on changes in number, rate or distribution of certain types of crime. The types of crime of most interest were those which:

- Result from the presence of new (BART) structures or the activity that centers around them, and
- Affect population groups living in and traversing areas outside stations and BART line areas.

For example, a new BART station with a lighted parking lot may be an invitation to vandalism such as breaking lights or marking walls with graffiti. Activity centering around stations, such as the attraction of vehicle and pedestrian traffic, may provide opportunities for persons to commit auto-related crimes and to move through neighborhoods inconspicuously while committing residential crimes. Since BART, at the time of this study, was operating on an interim basis during mostly daylight hours (weekdays only, 6 AM to 8 PM), it was expected that most crimes related to activity centering around the new structures would occur during BART's operating hours. However, crimes related to the presence of new structures were assumed to occur at any time, including nights and weekends.

RESEARCH QUESTIONS AND RATIONALE

Structuring the Approach

Initially, a general information gathering effort was conducted to provide preliminary indications of extent, locations and likely causes of BART's security impacts. This included a literature search of (a) prior studies on crime attributed to transportation system facilities and operations, and (b) research on probable causes of various types of crime.[2]

Direct observations were made and public officials were interviewed to determine where, if at all, and what BART-related impacts might be occurring. The objectives of observation were both to find traces of the occurrence of criminal activity (e.g., broken lights), and to observe possible crime-related behavior such as loitering in areas around BART stations and in BART line areas. During the first phase of the Environment Project's community monitoring program, public officials in all local jurisdictions adjacent to the BART line were asked whether BART had created or accentuated any crime problems in neighbor-

[2]See Bibliography.

hoods adjacent to the BART system. BART police were also asked to identify crime problems on BART property outside stations and along line areas which might be related to the presence of BART's facilities or operations.

The initial effort indicated that line versus station areas and urban versus suburban station locations were potentially important determinants of the incidence and variation of BART's security impacts. Further analysis of BART-related security impacts was therefore organized according to this structure.

In line areas which were generally not centers of BART-related activity, it was expected that the imposition of new structures was the outstanding change created by BART which could contribute to changes in crime. New structures such as roadway underpasses or embanked BART lines could serve as hiding places for criminals or as escape routes or barriers. The linear parkways, centers of activity and places of new structures and landscaping were expected to exhibit,if anything, crime characteristics of other line areas and of other inner suburban parks. Station areas, unlike BART line areas, were expected to be experiencing crimes related to activity centers, high amounts of auto, bus and pedestrian traffic, and unattended parked vehicles. Station areas were also expected to experience problems related to the presence of structures.

Variations in impacts appeared also to be related to location in urban or "center city" versus suburban areas. The terms "urban" and"suburban" are here used only in a general sense to differentiate between high activity, high density, usually "downtown" areas and other station locations less intensively developed.

In station areas, traffic levels, land use and population density appeared to be key causal factors behind BART-related impacts. Station areas classed as suburban, typically have primarily high auto traffic levels and most have parking lots, while most "urban" station areas have high BART-related pedestrian volumes and no parking facilities. Suburban stations are collectors of patrons and often are located in residential areas while central city stations serve as distributors of patrons to work places and have higher population densities.

Resultant Research Questions

Have crime or crime-related activities changed disproportionately on or near BART lines in center city or suburban areas?

Expected Findings

From preliminary observation and interviews with police spokes-

men, it was expected that crime had not changed appreciably in any line areas.[3] However, it appeared that security was perceived by at least some residents to be a problem in the BART Albany and El Cerrito linear parks, but no crime problems were apparent in the other parkway area.

Have crime or crime-related activities significantly changed and been attributed to BART in suburban station areas?

Expected Findings

The initial investigation showed that auto-related crimes and petty theft had increased substantially in some station areas while the incidence of person-to-person crimes seemed unaffected by BART's presence. Parking lot crime was considered to be more of a problem in certain station areas than in others.

METHODOLOGY

The approach with respect to security aspects of social impact is similar to the safety study in that general information was gathered which then laid the groundwork for more detailed investigation.

Multiple data sources were then used as an effective means for a general evaluation of impacts. Data sources for this type of assessment, along with general strengths and weaknesses, are discussed briefly.

Interviews

In all areas, except where it seemed certain that there was no significant BART-induced effect, police, local officials and others were interviewed to substantiate initial findings through their opinions and provide insight as to why change had occurred.

The importance of interviewing patrolmen as well as police officials was identified early in the study. Interviews with BART and local police officials allowed information to be gathered concerning the overall crime situation as well as police policy, while interviews with station agents and patrolmen provided valuable inputs about day-to-day criminal activity near BART lines and stations.

---

[3]The incidence of rock throwing at trains, though a significant problem for BART, was not analyzed in this part of the study. Crimes within stations and on the line will be studied in Phase II of this project.

Observation

Since it was not feasible to analyze the security impacts in detail in all areas, a limited number of suburban as well as urban sites were selected for intensive study and observation. Sites were selected to represent the different major combinations of probable security impact determinants throughout the system. These probable determinants and resultant location types were derived from initial discussions with officials and preliminary observation. Observation at sites provided further evidence of probable causes of variation in crime levels. As examples, linear parks were examined for potential hiding places and specific central city station areas were observed to see if loitering was a product of the presence of plazas, characteristics of surrounding land use, (activity center versus residential) or characteristics of population groups involved.

Crime Statistics

Whenever feasible and when applicable, crime reports, trends and statistics were analyzed. However, detailed analysis was performed only at specific selected sites.

Generally, it was found that local jurisdiction crime statistics were not grouped by geographic area in such a way that readily accessible, meaningful evaluations of reported crime in neighborhoods adjacent to BART were possible. For example, in one area, data was grouped by 1960 enumeration districts (these no longer exist, so easy comparison with 1970 Census data was not possible) and was only available by costly computer operations. In some small suburban areas, local jurisdiction statistics were not catalogued by location or crime type. Also one BART station is surrounded by three jurisdictions and the data for the jurisdiction with most of the surrounding area was found to be on cards organized chronologically for the entire city.

It appears that there is a need for consistent and accessible reporting of crime by jurisdiction. It is suggested that crime data be computerized or put into some readily accessible form wherever possible. Data should be classified in a common scheme, perhaps by census tract and block or special police districts that share similar characteristics (either in terms of similarity of population groups or area size). It is important also to recognize that variation in reporting practices also results from different levels of coverage of an area and local police policies. However, it seems unlikely that this will change.

FINDINGS

The Pre-BART Environment

As already discussed in preceding sections, in order to define the existence of an impact, it was necessary to form a baseline condition from which comparisons with present conditions could be made. This is described in terms of assumed security impact determinants, such as traffic volumes, population density, land use, income, background crime levels and visibility of local police, in a present day environment without BART. Basically, it is an update of pre-BART conditions to the BART timeframe built on the BART Impact Program's Generalized NoBART Alternative[4], with further specification provided by the present study team's compilation of specific changes.

Security Determinants

It appears that the distributions of traffic volumes, population density, and land use may well have been different from present conditions if BART had not been built.[5] However, there is no indication that income distribution, crime levels and visibility of local police would be different.

Household Income: There does not seem to be any obvious difference between the actual income distribution with BART and that in a hypothetical environment without BART. However, no formal analysis of income distribution changes has been made.

Background Crime Levels: It is assumed in this analysis that the distribution of crime in a NoBART environment would generally be similar to that for the distribution of non-BART-related crime. According to public officials, crime has generally and steadily increased over the past few years, particularly in the most rapidly growing outer suburban areas, and in the most economically depressed inner suburban locations.

Visibility of Local Police: It is also assumed that in a NoBART environment local police forces would be no more or less visible than they are today, and law enforcement procedures would generally be the same. According to local police officials, enforcement procedures have not changed significantly except where increased population growth has required expansion of forces.

---

[4]"Formulation of the Generalized NoBART Alternative," Metropolitan Transportation Commission, February 15, 1975

[5]These determinants are considered in detail under "Safety," (pp.40-41).

The BART Environment

Crime in BART Line Areas

BART has generally not led to increased crime in areas between stations along the line. However, personal security is perceived by some residents to be a problem in the Albany and El Cerrito BART linear parks.

BART line areas such as those under aerial structures and line overpasses do not appear to be used as hiding places for criminals, escape routes or focal points of increased crime. According to local jurisdiction police officials and patrolmen and BART officials, BART line areas are not known to be used as escape routes or hiding places. The only incidents mentioned were those when suspects in downtown areas ran through underground stations and then into BART subway tunnels, and in other areas when suspects climbed or cut through at-grade trackway fencing. Both types of incidents were very rare.

In addition, no evidence was found of line areas being used as focal points of criminal activity. Without exception, interviewed local officials stated that crime had not increased disproportionately in neighborhoods near the BART line and that they were not aware of any evidence showing that criminal activity was occurring in line areas.

This study's analysis of BART statistics on incidence of reported crime since the commencement of Transbay service (September 1974 through December 1974) showed a total of 14 reported crimes[6] in trackway areas[7] (not including station areas) on all four BART lines. Six of these occurred on the Richmond line and four were on the Fremont line. This reported incidence of trackway crime represents only about one percent of the system's total reported crime. Table 5.1 is a tabulation of these line-area crimes. Since BART's surveillance of line areas is generally not high, it is possible that more incidents may be occurring than are reported. However, no evidence was found of any significant crime problem.

---

[6]This total does not include rock throwing at BART trains or trespassing.

[7]There are approximately 71 miles of trackway.

TABLE 5.1
REPORTED TRACKWAY CRIME(NOT INCLUDING STATION AREAS)
BY LINE*

	Lines			
	Concord	Fremont	Richmond	Daly City
Crime Type				
Person Crimes	0	0	0	0
Property Crimes	2	3	5	2
Other Offenses	0	1	1	0
TOTAL	2	4	6	2

*September through December 1974, offenses only.

SOURCE: BART Police Services Department, Report of Offenses and Miscellaneous Reports.

Linear Parks: Although incidence of crime in BART's linear parks tends to be insignificant, there is apparent concern among some residents about security at the Albany and El Cerrito parks.

The Albany and El Cerrito linear parks, portions of BART right-of-way under an aerial line structure, traverse two inner suburban East Bay cities, El Cerrito and Albany, and connect with two BART stations. The parkways were built to show how rights-of-way under an aerial structure can be treated so that the structure will be more aesthetically acceptable to the communities in which they are located and offer a more attractive view to the commuter. The project consists of some 2.7 miles of right-of-way in El Cerrito and Albany averaging approximately 40 feet in width with some portions narrowing to 25 feet. The aerial structure is composed of reinforced concrete "T" supports spaced every eighty feet and concrete beams about twelve feet above grade, supported by the "Ts"."

The route which the parks cross was described as follows in a report of the project:

> "The route traverses developed residential, commercial and industrial areas and abuts several public land uses including a school, a park, a senior citizens' center, a nursery school, and a library. The residential development is a mix of single and multi-family housing, with modest single-family houses predominating. Median

value of the housing, according to 1970 census data for census tracts surrounding the route, generally falls between $21,000 and $25,000. Running parallel to the route several blocks to the south is San Pablo Avenue, a major commercial strip serving Albany, El Cerrito and adjacent communities."[8]

Not stated above is the fact that one side of each park is bordered by a lightly used at-grade railroad line. It is also important to note that some portions of the right-of-way adjoin or parallel city streets, while some areas fall within street blocks and are accessible only from each end of the park. Other parkway areas are directly accessible to BART stations.

The parks contain pathways for pedestrians and bike use and focal points of activity such as sandboxes and shuffleboard areas. In addition, the parks are well landscaped with many trees and shrubs. Screen planting was used to define the parks from the adjacent railroad tracks and medium height, fast-growing shrubs were used to screen adjacent parking lots, and industrial and commercial rear lots. Tall trees were planted around activity focal points.

Parkway lighting is generally random and ranges from moderate to low. In some parkway areas, it has been judged as inadequate both by observers and local officials.

Monitoring of crime in the parks and adjacent neighborhoods by both cities through which they pass has revealed no disproportionate increases in crime. Crimes which have occurred have been judged by police officials as similar to those in other city parks more distant from BART. Police officials from Albany (almost three-fourths of a mile of park lies in Albany) stated that no additional crime had been found to occur in the parkway with the exception of infrequent incidents of vandalism of lights, trees and park furniture. This low incidence of crime may be related to the fact that the Albany park is bordered by a major street and thus is visible to local law enforcement agents and passers-by. Also, the surrounding neighborhoods generally have a history of low crime levels.

El Cerrito police officials stated that there had been no significant level of crime in the parks but that there had been some purse snatches and sex offenses. From January 1973 (when the police began to keep records on the park) to February 1975 there have been six purse snatchings and seven sex offenses, three of which were committed by one person.

---

[8]"Linear Parkway, Bay Area Rapid Transit Urban Beautification Demonstration Project," page 3.

The officers also stated that parkway lights were vandalized when the park first opened but the problem had decreased. (It was further stated that these types of crimes were typical of incidents in city parks and that the incidence of parkway crime was generally lower than that in other city parks.)

Officials of both police forces credited this lack of impact to frequent patrolling of the parkway area, the many residences nearby, and the fact that the park tends to be used as a pathway more often than as an activity center. The Albany park runs parallel to a major street which is patrolled from two to three times per hour. However, in El Cerrito surveillance by police car is only possible in places where streets intersect the park. This surveillance problem has been resolved by the use of a three-wheeled vehicle which patrols the park at least twice during the daylight hours and twice in the evening.

Although the incidence of crime in the parks is low, some El Cerrito senior citizens have complained to the city's police department about park security and view the area as unsafe. When asked about these complaints, police officials noted that the city's Committee on Aging had complained about personal security in all of the city's parks. Senior citizens were not interviewed in this phase of the study.

Observation of possible crime-influencing factors (determinants) in the Albany and El Cerrito linear parks showed that these concerns are understandable. Landscaping and the frequent aerial structure pillars create shadows and could easily provide places of concealment for criminals. In addition, it was noted, as stated earlier, that lights are placed randomly throughout the park, creating some areas of shadow. Several lights were broken.

BART and local police stated that crime in the other park area, Concord, was insignificant even though there is generally more use of the Concord park than of the Albany and El Cerrito parks. However, the Concord park is generally more visible to adjacent streets and has fewer places of concealment than the demonstration parks.

Crime in Central City Station Areas

Crime has not been a problem in urban BART station areas and although loitering is a frequent occurrence in station plazas, it is not generally viewed as an annoyance by local residents or police officials. Although pedestrian traffic levels are

high at most center city stations, it appears that BART has had no significant effects on crime either in station plaza areas or in surrounding commercial or residential areas. This assertion is based on interviews with BART station agents and BART and local jurisdiction patrolmen who work each of the center city station beats, police officials, as well as direct observations and a trend analysis of selected crime data for two station areas and similar control sites.

Plaza Areas: It is appropriate at this point to describe the plaza areas at the eight operating center city stations. Except at the Powell/Market station, they are generally flat areas with benches and landscaping. Station entrances are typically stairs and escalators descending from the middle of the plazas. The Mission Street stations' plazas which are four-sided, similar areas on diagonally opposite street corners, are open to major streets on two sides and fenced on the other two. These two pairs of plazas are basically identical. The Powell/Market plaza in San Francisco's central business district is partially at street level near a major street intersection. However, most of the plaza area is below street level. There are two major plaza areas, which are connected by a lighted, covered wide passageway under a street. The lighting in the passageway is low during daylight hours. Since the center city stations' plazas are located in high activity areas, they tend to be places where people congregate and street vendors sell goods. However, despite the very intense pedestrian activity in the area, the subsurface plaza area at Powell and Market is generally not heavily used, while other plaza areas are more active.

According to interviewed police officials and patrolmen, there have been no crime problems in center city station plaza areas. They stated that these areas were generally not being used as hiding places or escape routes for criminals or as centers of criminal activities. Oakland police patrolmen pointed out that since the commencement of BART's operations in what are generally known as high crime activity areas, only six suspects were found running through plazas into BART stations to escape police. San Francisco police spokesmen said they knew of no such incidents. The only criminal activities mentioned by BART police officials or station agents were infrequent purse snatchings and vandalism to structures at one San Francisco station plaza (Powell and Market station plaza) in the hub of the downtown area. The only evidence of center city criminal activity actually observed during this study was graffiti at two stations.

BART crime report trends for 1974 Transbay service support observations and police officials' statements. As shown in Table 5.2, few incidents have been reported in urban station plaza areas.

TABLE 5.2
REPORTED CRIME BY URBAN STATION PLAZA AREA*

	Berkeley	Oakland	San Francisco	
			CBD	Mission
	(1 Station)	(2 Stations)	(3 Stations)	(2 Stations)
Crime Type				
Person Crimes	0	1	1	0
Property Crimes	0	0	2	2
Other Offenses	0	0	6	0
TOTAL	0	1	9	2

*September through December 1974

However, observers did note that there were several potential hiding places in the Powell/Market station sub-street plaza area. These hiding places are created by (a) shadow from the plaza's sloping sides, (b) hidden corners, particularly in the secondary plaza area away from the station entrance, and (c) low lighting in the passageway which connects the two subsurface plaza areas. The presence of hiding places and shadow, in addition to the inconvenience of the below-ground location, may be deterring plaza use, particularly by women.

Loitering: At the stations in central business districts, loiterers tend most often to be elderly persons, transients, street vendors and other persons who have free time during the day. Also, there are generally more men than women attracted to these areas. Other center city stations farther from the hub of downtown activity appear to most often attract elderly persons and juveniles who are nearby residents.[9]

The loitering which occurs in the Powell/Market plaza area is regarded as a nuisance by police officials but apparently neither deters patrons from using BART, nor impedes nearby pedestrian movement. The loitering is regarded as a nuisance by interviewed officials because they view the potential for

[9]The above description is based on impressions of local police officers, station agents, and direct observation. No on-site interviews were conducted.

crime as being higher when many idle persons congregate in an area than when there are fewer people and more constant movement. Also, police occasionally receive complaints about panhandlers and intoxicated persons in the area, not unlike that which occurs in other downtown park sites such as Union Square. Observation supported the view that loiterers have generally not interfered with BART patronage or nearby pedestrian movement.

Loitering at center city stations located on the fringe of downtown (Mission Street, San Francisco) is generally not viewed negatively by police patrolmen or residents, since gathering places tend to be used most often by local residents. The plaza areas have become places where juveniles and older persons congregate.

Neighborhood Crime: In commercial and residential areas surrounding BART, no evidence was found of any BART effects on crime levels or distribution. Local police officials and patrolmen's claims that BART has not caused changes in criminal activity were supported by a trend analysis of selected crime reports for two representative center city station neighborhoods.

Comparison of trends for selected reported crimes in (a) the mostly commercial areas surrounding the Powell/Market station in San Francisco and a similar control site, (b) the residential and commercial neighborhoods adjacent to the 16th and Mission Street station in the outskirts of the downtown area and a similar control site, showed no significant differences between control sites (similar to NoBART environments) and station areas.[10] For the Powell/Market station area, 1973 and 1974 monthly trends of total reported crimes, purse snatchings and "other" burglary (essentially commercial burglary) in a one-by-two block area surrounding the station and a similar nearby area were studied. For the Mission Street station area, 1973 and 1974 total crime reports, residential burglaries, purse snatchings and "other" burglaries were compared for a plot surrounding the station and an area of comparable size nearby. It is important to note that control sites were selected to represent the station areas had BART not been built. Police patrolmen familiar with selected station areas assisted in selection of these control sites.

Crime in Suburban Station Areas

Auto theft and related crimes, bicycle theft and vandalism are significant problems in many stations with parking facilities. Although this effect sometimes also spills over into the ad-

[10]Equivalent BART and pre-BART study periods were selected for crime trends comparisons.

jacent neighborhoods, it is still targeted at BART patrons unable to find parking spaces in the BART lots rather than at nearby residents. However, throughout the system, personal and residential property crimes do not appear to have increased significantly due to BART.

Parking lot crime trends are derived from study of BART police crime reports for the 1974 months of BART Transbay service (September through December) and from interviews with BART and local police officials and patrolmen. Crime trends in surrounding neighborhoods were derived from review of crime reports in two representative suburban areas and interviews with local police officials and patrolmen.

Total Crime: Although the incidence of reported total crime[11] (reported offenses) in BART lots during the last four months of 1974 has varied widely from one station to another, it appears that the reported incidence of parking lot crime is at least as high as that for total crime within one to two blocks of most of the stations in question. The only exceptions appear to be Oakland West and Lake Merritt, where it appears that parking lot crime may be less frequent than that in surrounding areas. This assertion is based both on police spokesmen's statements concerning a wide range of stations and comparisons of parking lot and adjacent neighborhoods' reported total major crimes for two selected station areas. It should be noted that the types of crimes which occur in parking lots are somewhat different from those in neighborhoods surrounding stations. However, comparison of crime levels in the two areas gives a reasonable indication as to whether generally more criminal activity is occurring in station areas than in surrounding neighborhoods.

Total lot crime, which is used here as an indicator of a general level of criminal activity, appears to be highest in areas with low income populations and moderate to high levels of already-existing criminal activity. These two factors appear to be the only plausible determinants shared by stations with lots where crime levels are highest. Parking lot size, use, overflow, station patronage, level of surrounding activity and proximity to other similar facilities are alternative determinants which could be hypothesized but showed no consistent relationship.

The station with the lowest level of parking lot criminal activity is adjacent to police headquarters; it is

[11]The three most frequent types of crime are auto theft and related crimes, vandalism and bicycle theft. These constitute most of the total crime.

TABLE 5.3
PARKING LOT REPORTED OFFENSES BY STATION*
(SEPTEMBER TO DECEMBER 1974)

STATION	NUMBER OF REPORTED CRIMES
Fruitvale	45
Coliseum	41
Ashby	39
South Hayward	38
Daly City	36
Hayward	35
Bay Fair	34
San Leandro	34
Rockridge	34
Pleasant Hill	31
North Berkeley	27
Concord	27
Orinda	26
El Cerrito del Norte	26
MacArthur	21
Richmond	21
Walnut Creek	20
El Cerrito Plaza	17
Lafayette	15
Union City	14
Fremont	10
Oakland West	8
Lake Merritt	7

*Includes Miscellaneous Reports

likely that the high visibility of police is an additional deterrent to crime. Another exception is found in the low level of crime at the Oakland West station, a low income, high crime area. However, this station's very low patronage and parking lot use (the system's least active station) may be factors. Richmond, the only suburban station with a pedestrian mall, has not experienced any significant crime problems in the mall area. (See Table 5.3)

Table 5.4 shows the distribution of crime type in suburban station parking lots with property crimes the most frequent type occurring in all areas. Observation showed that these lots are essentially unattended and out of view of station agents due to station design.

TABLE 5.4
PARKING LOT/PLAZA CRIME TYPE

	PARKING LOTS				PLAZAS	
	Concord Line (6 Stations)	Richmond Line (6 Stations)	Fremont Line (9 Stations)	Daly City Line (2 Stations)	Daly City Line (2 Stations)	TOTAL
PERSON CRIMES						
Assault/Battery	0	1	0	1	0	2
Strong Arm Robbery	0	2	2	0	0	4
Purse Snatching	0	0	4	0	0	4
PROPERTY CRIMES						
Auto Theft, Auto Burglary	48	42	70	8	0	168
Petty Theft	43	52	77	8	1	181
Vandalism	27	26	35	3	1	92
MISCELLANEOUS						
Sex Offenses*	1		5	0	0	6
Narcotics	1	1	9	0	0	11
Disorderly Conduct	3	1	2	1	0	7
Suspicious Persons	9	11	14	2	0	36
Other**	20	15	40	21	1	97
TOTAL	152	151	258	44	3	

*No rapes were reported
**Minor crimes and miscellaneous reports

A trend analysis was made of total major offense reports at two representative suburban station areas within one to two blocks of stations. The results, along with interviews of police officials, indicated that total crime in neighborhoods adjacent to stations had not changed significantly but that the reported incidence of auto-related crimes had increased in some areas.

Auto-Related Crimes: Auto-related crimes appear to be the most frequent types of crime in BART parking lots. These are also the only types of crime found to be increasing appreciably in neighborhoods adjacent to stations.

BART Parking Lots: A BART officer interview in a news article (San Francisco Examiner, January 15, 1975) stated "Our gigantic problem is auto burglaries." The article entitled "BART Parking Lots -- Big Field for Crime," pointed out that "BART's parking lots are popular with auto boosters because the burglars have as much as 11 hours to work on a single car while the commuter is at work." The article stated further that auto thefts have increased substantially from 1973 to 1974. In 1973, there were 105 auto thefts as compared to 184 in 1974 and auto burglaries increased from 46 to 193, a 147 percent increase.

This public statement is supported by BART crime report statistics as analyzed in this study and also by the study's interviews with BART police officials. According to BART crime reports, almost two-thirds of the stations with parking lots had auto thefts or auto burglaries reported during 1974 Transbay service. During this time, 168 auto thefts and auto burglaries were reported in BART parking lots.

One station (Coliseum) had approximately one-third more auto-related crimes during this period (21 reported crimes) than did any other station. BART police officials attribute the high incidence of auto crime at this station to the fact that the Coliseum area is one of the most economically depressed residential areas along BART and has a high crime rate.

Ten or more crimes were reported at Concord, del Norte, Orinda, Fruitvale, Hayward and Ashby stations. Not unlike the Coliseum station, Ashby, Fruitvale and Hayward are surrounded by low income neighborhoods. The other three stations are in relatively high income areas but this study's investigations could not identify why parking lot crimes have been higher at these than at other similar station areas. The distribution of auto-related parking lot crime is shown in Table 5.5.

Neighborhoods Adjacent to Stations: Increases in on-street auto crime were the only notable BART crime effects in suburban areas. (These increases have been most significant in station areas where overflow parking lots force patrons to park on the street. Local residents are generally not affected.) A trend analysis was made of total major offense reports at two representative suburban station areas within one to two blocks of stations. The results, along with interviews of police officials indicated that total crime in neighborhoods adjacent to stations had not changed significantly but that the reported incidence of auto-related crimes had increased in some areas.

TABLE 5.5
REPORTED PARKING LOT AUTO THEFTS AND
AUTO BURGLARIES BY STATION

STATION	NUMBER OF REPORTED CRIMES
Coliseum	21
Fruitvale	14
Ashby	13
Orinda	13
Concord	10
Hayward	10
del Norte	10
Walnut Creek	9
Pleasant Hill	7
Bayfair	7
Richmond	6
South Hayward	6
MacArthur	6
Daly City	6
Lafayette	5
Rockridge	4
North Berkeley	4
Union City	4
El Cerrito Plaza	3
Lake Merritt	3
Oakland West	2
Fremont	0

Auto theft and burglary increases in neighborhoods adjacent to stations have been observed and reported where there are the highest numbers of on-street BART patron autos, Fremont and Daly City stations.

Local jurisdiction officials stated that auto-related crimes had increased significantly in these areas. Slight increases were noted in neighborhoods adjacent to South Hayward, Pleasant Hill and Lafayette stations, all stations with overflowing parking lots. However, it was not feasible to develop data to support these opinions.

More than twice the number of patrons autos (about 1,000 autos) are forced to park on the streets near the BART Daly City station than near any other station. This is a significant increase from the time prior to operations. The Fremont station ranks second in the number of autos parking outside lots (about 500 autos) and is an open space and commercial area with a low level of surveillance. The station with the third most on-the-street autos (350 autos), Union City (prior to lot expansion), has experienced no significant crime increases. The police officials credit this lack of increase to the fact

that Union City is not a well known area as are the two terminal station areas, Daly City and Fremont. Thus, auto thieves may not be cognizant of the Union City station's location.

A trend analysis of selected crime reports by month for 1974[12] conducted for a two block area surrounding the Daly City station and a similar control site supported Daly City police officers' impressions of increased auto-related crime:

- Reports of auto burglary and theft of auto parts were found to be at least eight times higher in the study area than at the control site; auto theft reports were three times higher in the study area. Incidence of other reported crimes was about equal in both areas.

- Over eight times the number of abandoned, towed, and obstructing vehicles (152 to 19) were reported for the study area as for the control site.

No significant increases in auto-related crimes have occurred at the two stations without parking lots (Glen Park and Balboa Park in San Francisco), both of which are sites of heavy auto traffic and on-street parking. Within two to three blocks of the Glen Park station, about 350 BART patron autos were observed parked on the streets in 1974.[13]

At Balboa Park station, estimates based on present study of observation indicate that there are at least 300 BART patron autos parked on nearby streets during the AM peak period.

However, officers interviewed who patrol these areas stated that although there are significantly more autos, no noticeable increases in auto-related crimes have occurred.
A trend analysis was made of reported auto thefts during periods just before and during BART operations for areas within approximately two blocks of the Glen Park station and a similar control site[14] (selected to resemble the assumed NoBART environment). It supported patrolmens' assertions of no noticeable

---

[12]Use of 1973 crime data was desired but it was not readily available.

[13]According to a SFDPW survey (December 19, 1974). However, estimates of patron on-street parked autos based on the BART Passenger Profile Survey II indicated that presently there may be almost twice that number of autos.

[14]San Francisco police officers familiar with the Glen Park area assisted in the selection of the control site.

increases in BART-related crimes. A slight but insignificant decrease in reported auto thefts for the Glen Park study area and an increase in auto thefts in the control area were found.

Presence of parking lots and high numbers of parked autos on adjacent streets were the only two potential determinants that seem to differentiate between places with neighborhood auto crime and those without.

However, other factors may be influencing the rate of auto-related crime that is occurring. For example, interviewed police officials in Fremont noted that it was particularly easy to commit crimes near the Fremont station since it is a commercial and open space area with no people present for long periods of time (unlike a residential area) to witness crimes. On the other hand, Daly City officials stated that the occurrence of crime is generally less than expected, given the approximately 1,000 additional patrons' cars. They cited the following characteristics as possible influential factors:

- The area is heavily patrolled (according to police officials and patrolmen interviewed, a beatman is always in the area, a saturation unit of three to five persons frequents the area when there are problems, two police assistant trainees have been hired to combat parking problems and a meterman patrols the area daily).

- The street lighting, particularly on the main street next to the station, is considered to be excellent. During the Knowles Corridor Project, in which streets were widened to accommodate BART-related traffic, lighting improvements were made.

Petty Theft and Vandalism: Petty theft[15] and vandalism have increased significantly in some areas outside suburban stations but have tended to be confined to BART parking lots.

Systemwide, the number of reported petty thefts was about the same as that of auto thefts and auto burglaries in parking lots (from September to December 1974, 181 incidents were reported). From a cursory look at bike and bike part theft statistics, it appears that about half of the reported incidents relate to thefts of bikes or bike parts.

The number of reported petty theft incidents ranges widely by station, from zero to 17 reported incidents during the early Transbay service period studied. The stations with the most

[15]Theft of property worth $200 or less.

petty theft (11 to 17 reported incidents) appear to be low or middle-to-low income areas (Ashby, Rockridge, San Leandro, South Hayward, Fruitvale, North Berkeley). Interviewed BART police officials stated that as with the incidence of other auto-related crime, the character of the surrounding neighborhoods, as represented by income levels, is probably the strongest determinant of crime occurrence.

During the last half of 1974 (July to December),[16] bike thefts were reported at all suburban stations except Lafayette, Glen Park and Balboa Park. The thefts were most frequent at the Ashby (13), El Cerrito Plaza (11) and Coliseum (10) stations, none of which have the greatest number of bike riders. The bike theft problem has prompted BART to change bike rack locations at 17 out of 25 stations and to install bike lockers at all but one station (Balboa Park). Previously bikes were not always stored in places in view of station agents.

The occurrence of vandalism is the third most frequent type of reported parking lot crime. There is no evidence that it is a problem in areas adjacent to station lots. During the last four months of 1974, 68 incidents of vandalism were reported even though about half the stations reported no incidents at all. The type of vandalism which has occurred most often is graffiti on exterior station structures in lots and vandalism to autos. The most incidents reported at any station parking lot was nine for the four-month period studied. It is not clear why there are more reported incidents in some stations than in others.

Other Crime: Generally, BART seems to have had little or no effect on (a) property crimes other than auto crimes, petty thefts and vandalism, and on (b) person-to-person crimes in parking lots and neighborhoods adjacent to stations.

This assertion is based on interviews with police spokesmen for local jurisdictions along the BART line, a trend analysis of reported crime in areas adjacent to three suburban BART stations, and examination of the incidence of parking lot crime during the last four months of 1974.

Loitering of suspicious persons and increased residential burglaries (originally expected by some local police officials to occur in outer suburban high income areas on the Concord line) have been insignificant.

Representatives of two suburban police departments stated that they had expected more of an influx of people and re-

---

[16]This period was selected for analysis so that summer months when bike riding is most frequent would be included.

sultant crime increases in the outer suburban areas but have found that their expectations were not warranted. A few loiterers and people not from the areas have been noticed in places near BART stations but no problems have been created.

One exception to the general lack of "other crime" problems has been the Coliseum station underpass. Some people have been accosted there with the two most frequent types of crimes being purse snatchings and strong arm robberies. The walkway is a covered tunnel-like structure without surveillance to deter criminals waiting to accost walkway users and it is located in a low income, high crime area. According to BART police spokesmen, there are no crime problems at the other three station underpasses in the BART system (e.g., Lafayette station underpass, Richmond underpass and pedestrian mall, and Bayfair underpass).

A look at the distribution of lot crimes other than the three major types (auto theft, petty theft and vandalism) revealed that reports of suspicious persons, narcotics violations, and sex offenses (other than rape) are the next three most frequent crimes. However, at no station lot were more than four suspicious person or narcotics reports or more than one sex offense report filed between September and December 1974.

Systemwide, during 1974 Transbay service, there were no reported rapes[17] or homicides (neither of these types of crimes has ever been reported during BART operations) and only four reported assaults, four reported strong arm robberies and four reported purse snatchings.

[17]It is important to note that nationally only a small percentage of rapes are reported.

VI. VISUAL EXPOSURE

DEFINITION AND SCOPE

When BART trains began running near residences it could be assumed there would be some loss of privacy due to BART riders being able to see into rear yards and houses. As shown in Figure 6.1, approximately 30% or 21 of BART's 71 miles are above-grade and close enough to expose adjacent houses and yards to potential loss of privacy. It was also possible that commercial advertising would respond to the new "audience" with increased signage and new locations. The visual exposure study was undertaken to determine the extent of these effects and the aspects of BART that cause them.

The Phase I study was based on a repeat of the pre-BART REIS "View from BART" photo study at selected sites.[1] The scope of the study was essentially systemwide although data collection was limited to areas that were part of the pre-BART study and further limited to those areas of nearby residences where observable responses might be expected.

RATIONALE AND RESEARCH QUESTIONS

In the Phase I study the objectives of determining the extent of loss of privacy due to passing BART trains were limited to detecting any observable responses, such as higher fences, fuller landscaping, or changes in the use of outdoor spaces due to such losses. In the second phase of the Environment Project detailed surveys of affected residents will be conducted. Feelings of privacy and visual exposure will then be fully investigated.

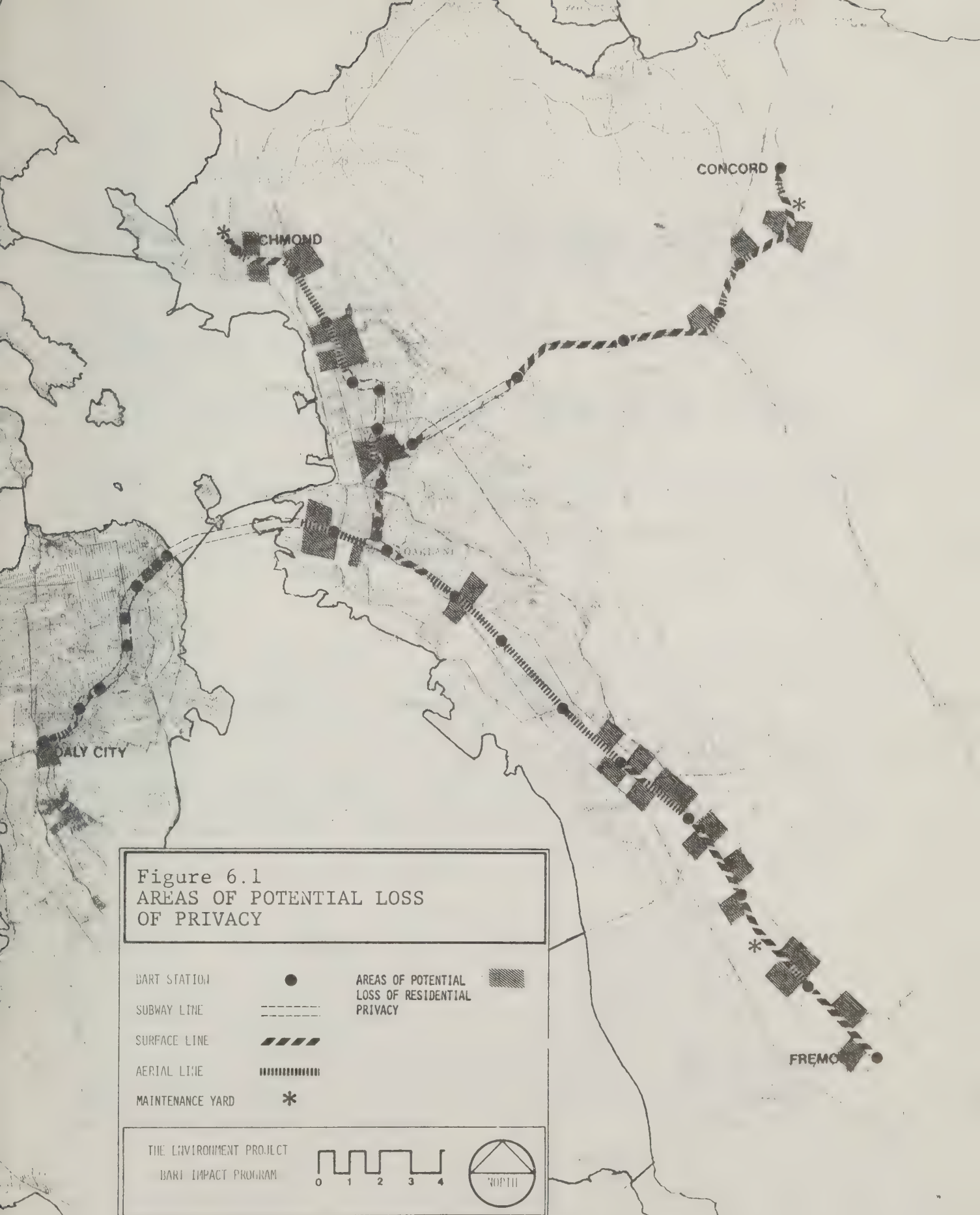
Three basic research questions were examined with respect to loss of privacy:

1. Which areas are potentially exposed to view from BART facilities?

2. In which of these areas has there been any observable response to potential visual exposure and what types of responses have occurred?

---

[1]Appleyard, D., op cit. This "pre-BART" study, completed in 1972, collected data on a wide range of questions including specific environmental concerns such as the privacy issue. Twenty-four "special sites" were selected for data collection relating to all questions.


CONCORD
RICHMOND
DALY CITY
FREMONT
Figure 6.1
AREAS OF POTENTIAL LOSS
OF PRIVACY
BART STATION
SUBWAY LINE
SURFACE LINE
AERIAL LINE
MAINTENANCE YARD
AREAS OF POTENTIAL LOSS OF RESIDENTIAL PRIVACY
THE ENVIRONMENT PROJECT
BART IMPACT PROGRAM
0 1 2 3 4
NORTH

3. What aspects of BART give rise to the observable response?

Changes in patterns of outdoor advertising due to BART was the objective of the second part of the visual exposure study. The criterion for BART-relatedness was clear evidence of being directed at BART riders through location and orientation. This study was made on a systemwide basis.

The same basic research questions guided this section as did the study of loss of privacy.

1. Which areas are potential targets of BART-directed advertising?

2. In which of these areas have there been actual changes in advertising? What sort of changes have occurred?

3. What characteristics of BART are associated with advertising changes?

METHODOLOGY

The methods for the study of loss of privacy were based on a repeat of the 1972 REIS "View from BART" photographs. The REIS series of photos, taken at each of 24 sites, depicts the view of adjoining areas as it would appear from the train. Both sides of the above-grade track in each of the 24 REIS special site areas has a corresponding series of pre-BART photographs, making a nearly continuous visual record of houses, streets, buildings and open space facing BART in 1972. At the time the pictures were taken, BART was operating on the Fremont line, consequently some observable responses may have occurred at those sites prior to the photo survey.

In the present study a new series of "View from BART" photographs was taken of sites selected from among the pre-BART sites. Seven sites were selected. Each has adjacent residences, where it was felt that visible responses would be most likely, based on review of the 1972 photos. While the BART series documented both sides of the track at each site, the 1975 series included both sides at only four of the seven sites. The three excluded sites either failed to have a significant number of residences or pre-BART photos did not include the first row of houses. A total of 11 sequences[2] were selected containing roughly 250 houses.

---

[2]A sequence is one of the pair of slides at each site.

The two sets of photographs were then compared in an effort to detect any observable change from 1972 to 1975 that might indicate a response to loss of privacy due to BART. Specifically, visual barriers, such as fences, walls, awnings, patio covers, increased landscaping and evidence of yard usage changes were part of this comparison. Each house and each yard were individually examined and compared where photos were available (some gaps occurred in both photo sets, as shown in the Appendix, so that comparisons were possible with about 70% of the selected frontage).

To examine increases in commercial and general advertising signage, two methods were employed. A systemwide visual check from the train was made and a representative of Foster and Kleiser, a large outdoor advertising company, was consulted by telephone.

FINDINGS

Loss of Privacy

With few exceptions, physical changes which might be considered responses to visual intrusion were non-existent.

Approximately 250 houses and apartment buildings were evaluated in the study. No changes in outdoor activities were observed. Some vegetation had grown while other vegetation had been cut back or removed. Small changes to houses (such as painting) had occurred, but major changes were virtually non-existent.

However, three houses, all at one site (Richmond, north side of the tracks between Nicholl Park and 23rd Avenue) showed structures which appeared to be visual barriers. Unfortuantely these houses were not well documented in the pre-BART photos, so it was not clear that these devices were installed after BART's construction or that they were in response to BART-related loss of privacy, although they do serve the purpose of obstructing views from passing BART trains into the houses. The devices are two vertical fence extensions running the length of two rear yards which do obstruct views into the yards and houses whether that is their purpose or not, and a window covering that completely obscures the window while allowing light to come in around the edges.

The Richmond site is unique in some respects. The houses are closer (about 30 feet) to passing trains than at any other point in BART's 71 miles. The line is on a very low embankment, so that train windows are just above the common fence height and views are directly into yards and windows rather than down at a sharp angle, as they are in many other locations.

BART-Directed Advertising

After a systemwide examination only two signs specifically directed at BART riders were found. Because of lack of interest by advertisers and local ordinances prohibiting it, BART-related increases in signage have not occurred.

This study was concerned only with signs erected in response to BART and therefore used the criterion of BART-directedness to examine signage. Most communities along BART's right-of-way have enacted ordinances prohibiting advertising directed at BART riders in zones 330 feet to 1000 feet on either side of the tracks. These ordinances allow for the removal of existing signs deemed to be BART-directed, although few if any have been challenged. Many billboards and commercial advertising signs on adjacent arterials are visible from BART as well as from the arterials. These signs pre-date BART in nearly every case, according to a representative of Foster and Kleiser.

Two examples of specifically BART-directed signs were found. One was painted on the end wall of an auto repair garage, and the other was placed on a roof adjacent to BART aerial structure. Neither of these signs is visible from nearby residences and streets.

The Foster and Kleiser representative indicated outdoor advertisers were not interested in directing billboards at transit riders because of many difficulties in reaching the transit rider audience. Train speed, frequent preoccupation of riders with reading and face-to-face conversation, and riders' inability to see forward were cited as incompatibilities between rapid transit and billboards.

BIBLIOGRAPHY

American Transit Association, Vandalism and Passenger Security, September 1973.

Anderson, Kenneth W., "Traffic Engineering to Reduce Accidents," Traffic Engineering, Institute of Traffic Engineers, September 1969.

Appleyard, Donald, "BART Residential Environment Impact Study," BART Impact Studies, Berkeley, Institute of Urban and Regional Development for Metropolitan Transportation Commission, 1973.

Arthur Young & Company, "Final Project Report and Analysis of Police Services Division," prepared for Bay Area Rapid Transit District, September 1973.

Automobile Safety Foundation, "Traffic Control and Roadway Elements - Their Relationship to Highway Safety" (1967 update).

Bancroft-Whitney Company, Deering's California Penal Code, Bancroft-Whitney Company, San Francisco, 1975.

Bay Area Rapid Transit District, Office of Research, "Passenger Profile Survey," February 1974.

Bay Area Rapid Transit District, Department of Marketing and Research, "Passenger Profile Survey II," January 1975.

Bernard, Keith, "Planning and Development of the BART Police Services Department," Proceedings-Fifteenth Annual Meeting, Transportation Research Forum, Volume XV, Number 1, 1974.

Conrad Associates, "Fringe Parking Facilities, Daly City Station, Phase I Report," prepared for Bay Area Rapid Transit, September 1974.

Duncan & Jones, "BART Multi-Modal Terminal Plan, City of Walnut Creek, California, prepared with Bay Area Rapid Transit, Metropolitan Transportation Commission, March 1974.

Dunn, J.W. and Leonard B. West, "Accidents, Speed Deviation and Speed Limits," Traffic Engineering, Institute of Traffic Engineering, July 1971.

Homburger, Wolfgang S., James H. Kell, and Norman Kennedy, Fundamentals of Traffic Engineering - 8th Edition, Institute of Transportation and Traffic Engineering, University of California, 1973.

Jacobson, Alvin L., "Crime Trends in Southern and Non-Southern Cities: A Twenty-Year Perspective," Research Previews, Institute for Research in Social Science, University of North Carolina, Chapel Hill, Volume 21, Number 1, April 1974.

JHK & Associates, "Revised Final Report, Miscellaneous Traffic Study, City of Lafayette," December 1973.

Johnson, Michael, "Role of Personal Security in the BART Impact Program," BART Impact Working Paper, Metropolitan Transportation Commission, January 1974.

Johnson, Ronald C., "Mass Transit Security in Chicago," Proceedings - Fifteenth Annual Meeting, Transportation Research Forum, Volume XV, Number 1, 1974.

Levine, Robert, "BART and the Handicapped," BART Impact Working Paper, Metropolitan Transportation Commission, November 1974.

Mayer, Peter A., "Relating Traffic Control and Roadway Elements to Highway Safety," Traffic Engineering, Institute of Traffic Engineers, June 1971.

Pignataro, Louis J., Traffic Engineering, Theory and Practice, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1973.

Transportation Research Board, National Research Council, "Crime and Vandalism in Public Transportation," Transportation Research Record 487, Washington, D.C., 1974.

Wilson, James E., "Simple Types of Intersection Improvements," Highway Research Board Special Report No. 93.

Yu, Jason C., "Establishing Relationship of Level of Service and Safety," Traffic Engineering, Institute of Traffic Engineers.

Notes of Meeting between De Wayne Guyer, Robert C. Pehrson (Design Coordination Officer), BART, and Harry M. Moses (Governmental Relations Engineer), BART, 12/18/74.

APPENDIX A

BARRIERS

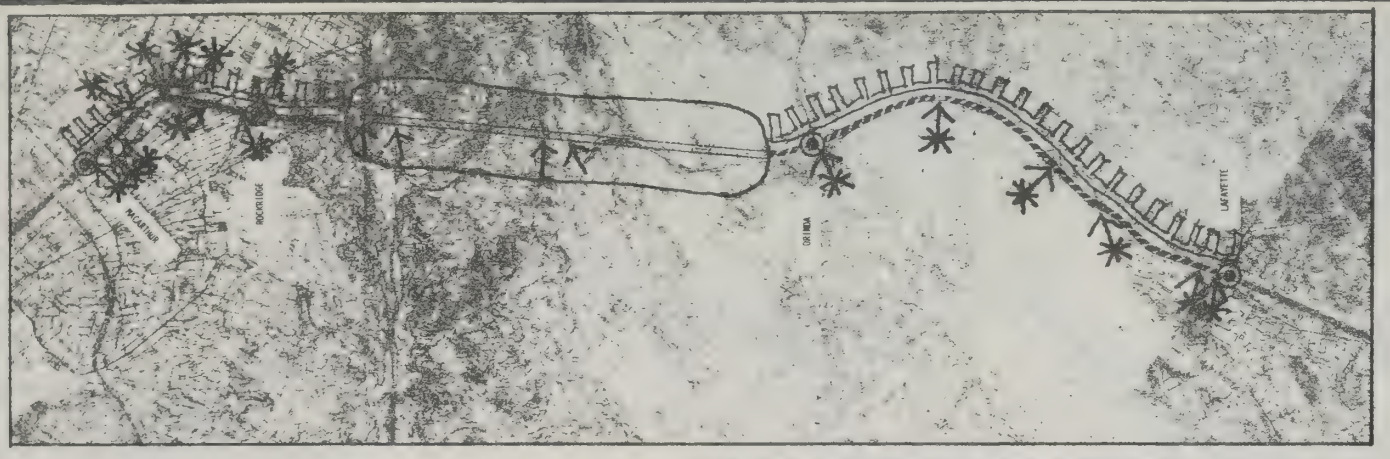
A1:

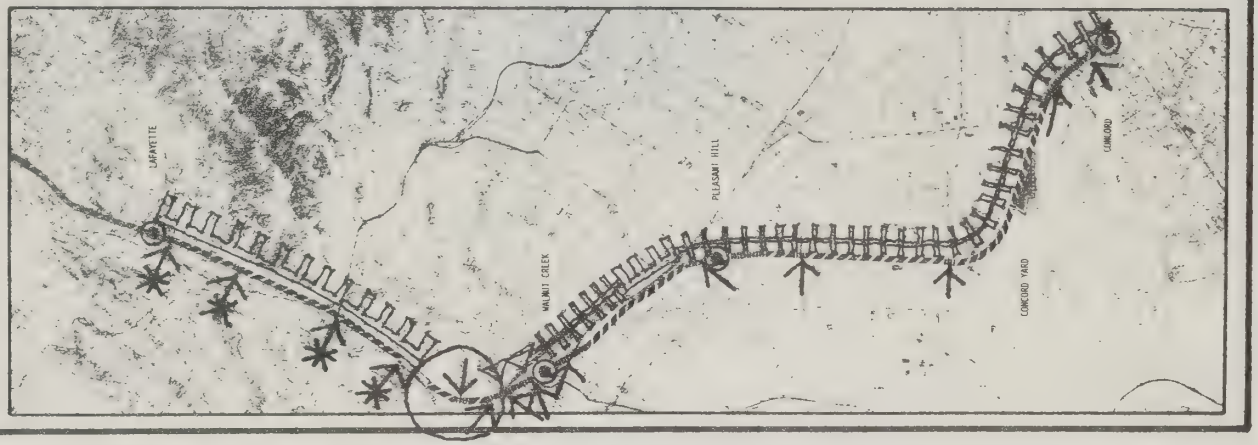
ADJACENT TRANSPORTATION

AND

GRADE CROSSINGS/SEPARATIONS

PRIOR TO BART





LEGEND

GRADE CROSSING

GRADE SEPARATION

ADJACENT TRANSPORTATION FACILITIES

FREEWAY

RAILROAD (HEAVY USE)

RAILROAD (LIGHT USE)

WATERWAY

ADJACENT TRANSPORTATION FACILITIES

NORTH

THE ENVIRONMENT PROJECT

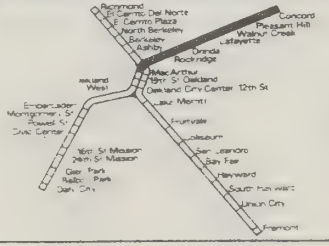
BART IMPACT PROGRAM

MAY, 1975

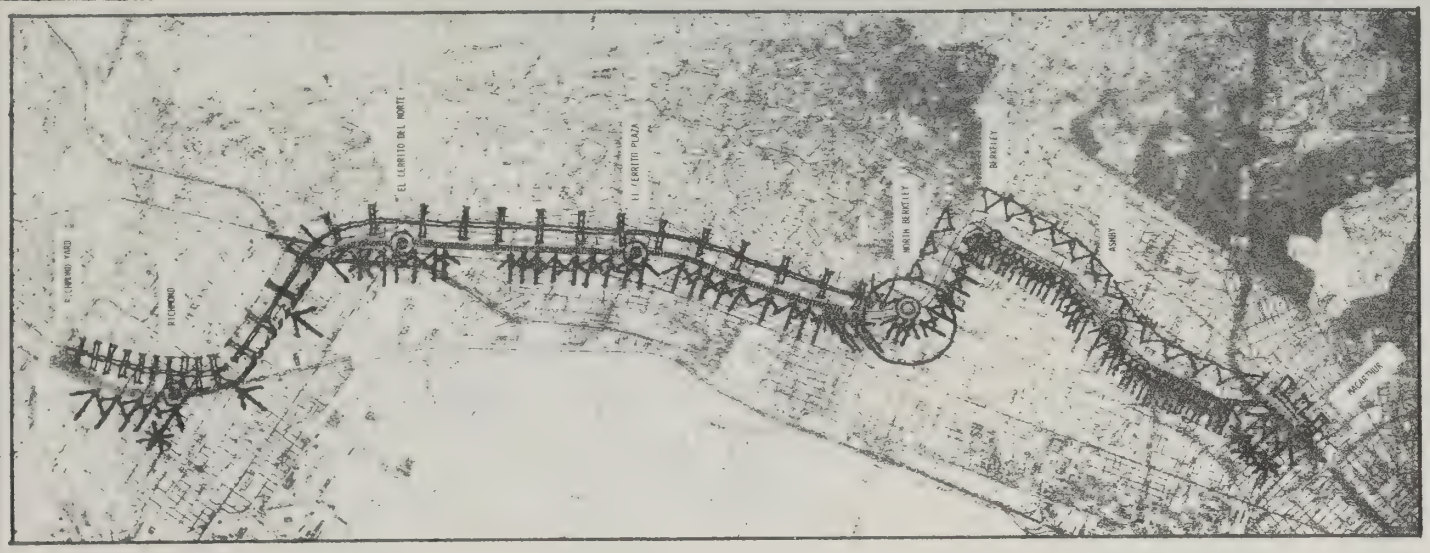
0 1 2 4 6 8

SCALE IN 1000'S OF FEET

APPENDIX A.1 - ADJACENT TRANSPORTATION FACILITIES AND GRADE CROSSINGS/SEPARATIONS (PRIOR TO BART)



CONCORD LINE



LEGEND

GRADE CROSSING

GRADE SEPARATION

ADJACENT TRANSPORTATION FACILITIES

FREEWAY

NORTH

THE ENVIRONMENT PROJECT

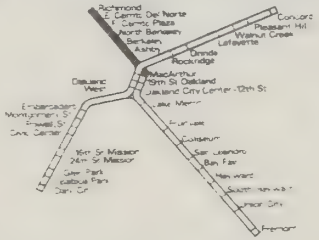
BART IMPACT PROGRAM

MAY, 1975

0 1 2 4 6 8

SCALE IN 1000'S OF FEET

APPENDIX A.1 - ADJACENT TRANSPORTATION FACILITIES AND GRADE CROSSINGS/SEPARATIONS (PRIOR TO BART)



RICHMOND LINE

LEGEND

GRADE CROSSING

GRADE SEPARATION

ADJACENT TRANSPORTATION FACILITIES

FREEWAY

NORTH

THE ENVIRONMENT PROJECT

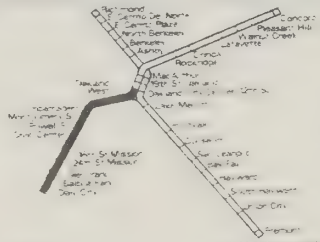
BART IMPACT PROGRAM

MAY 1975

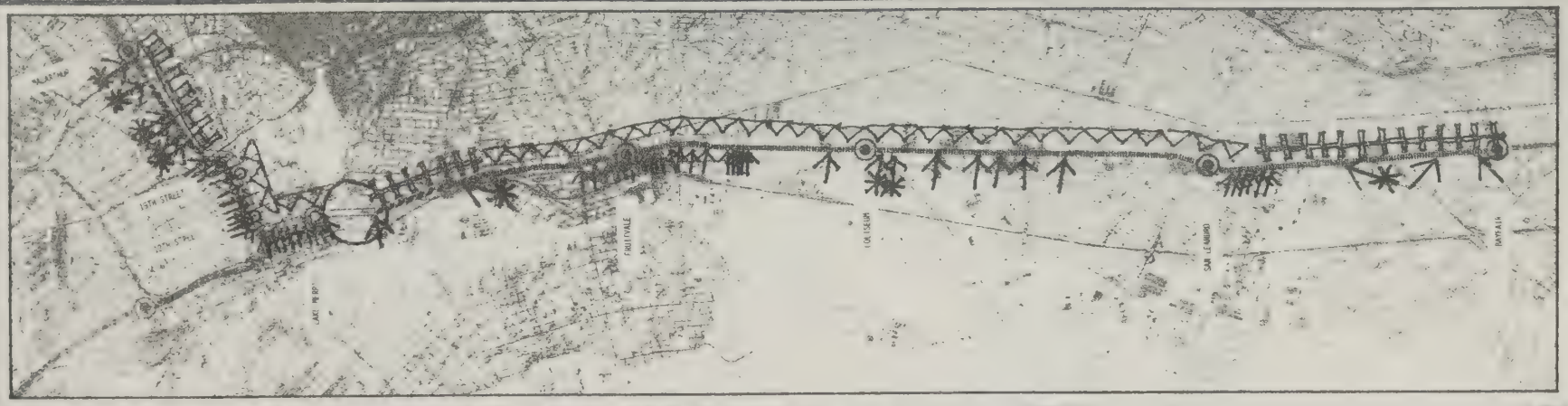
0 1 2 4 6 8

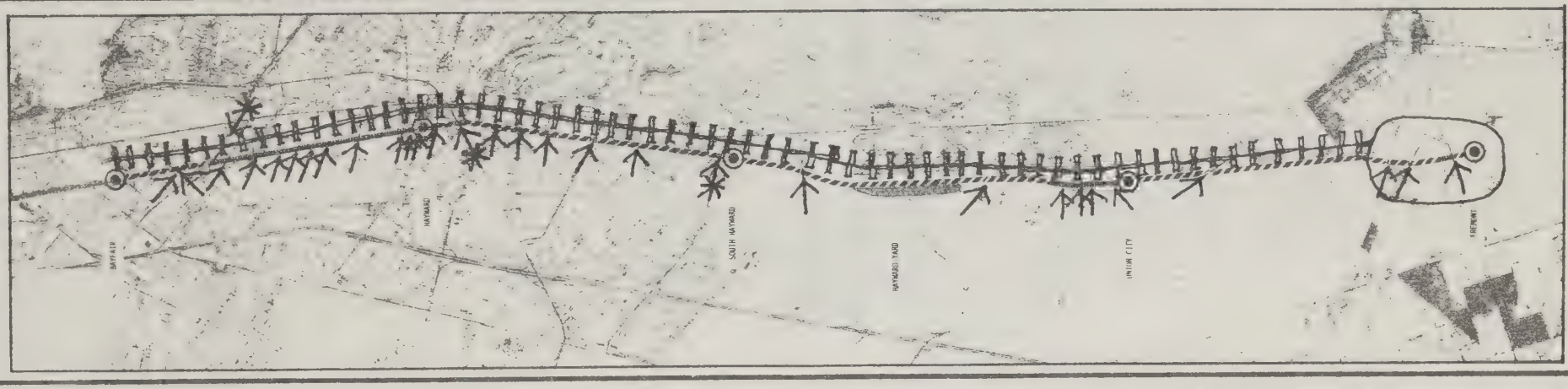
SCALE IN 1000 FEET

APPENDIX A.1 - ADJACENT TRANSPORTATION FACILITIES AND GRADE CROSSINGS/SEPARATIONS (PRIOR TO BART)



DALY CITY LINE





LEGEND

GRADE CROSSING

GRADE SEPARATION

ADJACENT TRANSPORTATION FACILITIES

FREEWAY

NORTH

THE ENVIRONMENT PROJECT

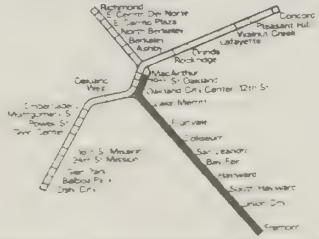
BART IMPACT PROGRAM

MAY, 1975

0 1 2 4 6 8

SCALE IN 1000 FEET PER INCH

APPENDIX A.1 - ADJACENT TRANSPORTATION FACILITIES AND GRADE CROSSINGS/SEPARATIONS (PRIOR TO BART)



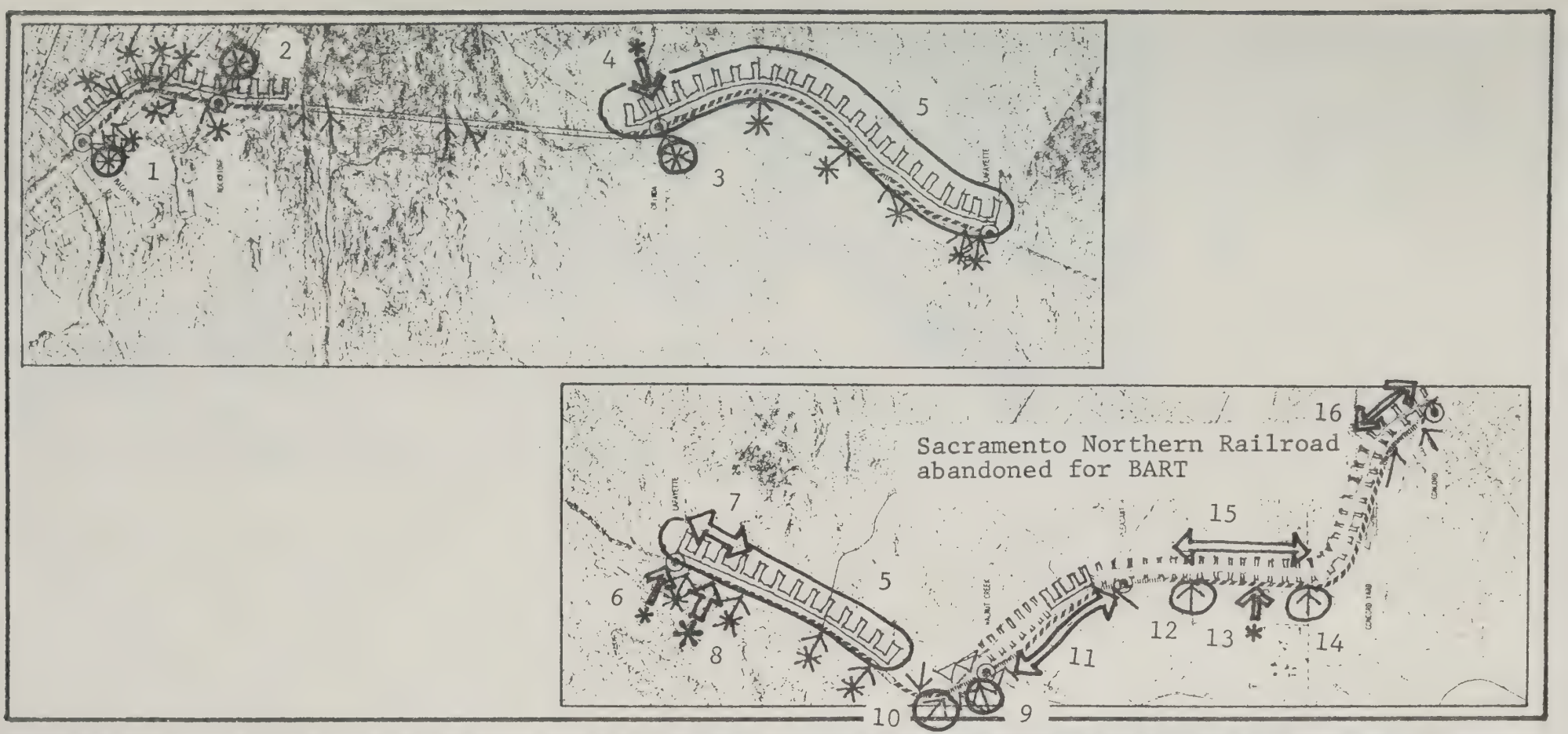
FREMONT LINE

A2:

CIRCULATION IMPROVEMENTS

ADJACENT TRANSPORTATION

AND BART CONFIGURATION



LEGEND

- BART CONFIGURATION AND FACILITIES
- SUBWAY LINE
- SURFACE LINE
- AERIAL LINE
- ABOVE GRADE STATION WITH PARKING LOT
- SUBWAY STATION WITHOUT PARKING LOT
- SUBWAY STATION WITH PARKING LOT
- MAINTENANCE/STORAGE YARD
- MAJOR ROADWAY
- MAJOR PEDESTRIAN ROUTE
- PROPOSED TRANSIT ROUTE
- CROSS STREET
- ROCKRIDGE STREET
- 17 REFERS TO APPENDIX A SPACE 17

NORTH

THE ENVIRONMENT PROJECT

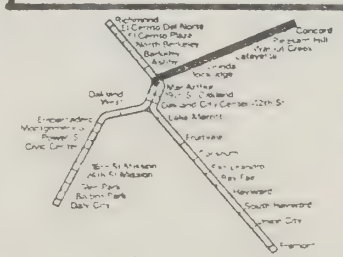
BART IMPACT PROGRAM

MAY, 1975

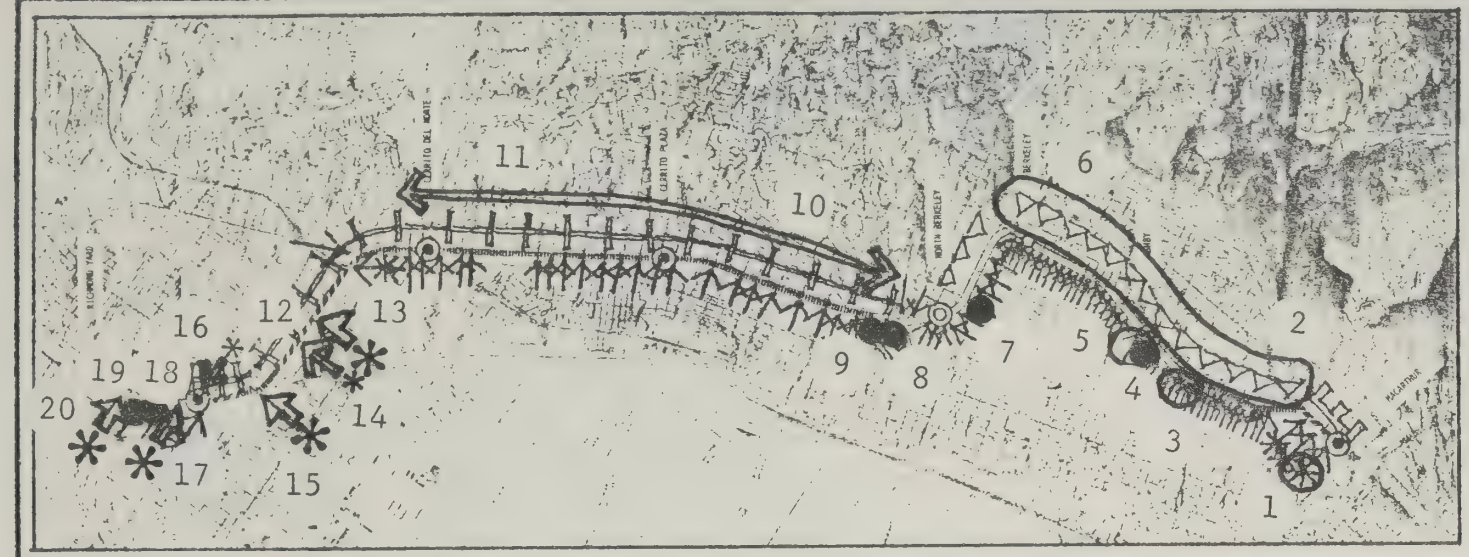
0 1 2 4 6 8

SCALE IN 1000'S OF FEET

APPENDIX A.2 - CIRCULATION IMPROVEMENTS ADJACENT TRANSPORTATION FACILITIES AND BART CONFIGURATION



CONCORD LINE



LEGEND

17

NORTH

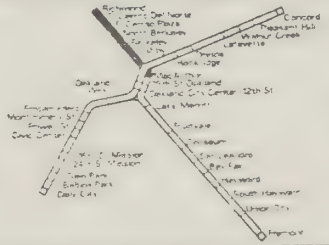
THE ENVIRONMENT PROJECT

BART IMPACT PROGRAM

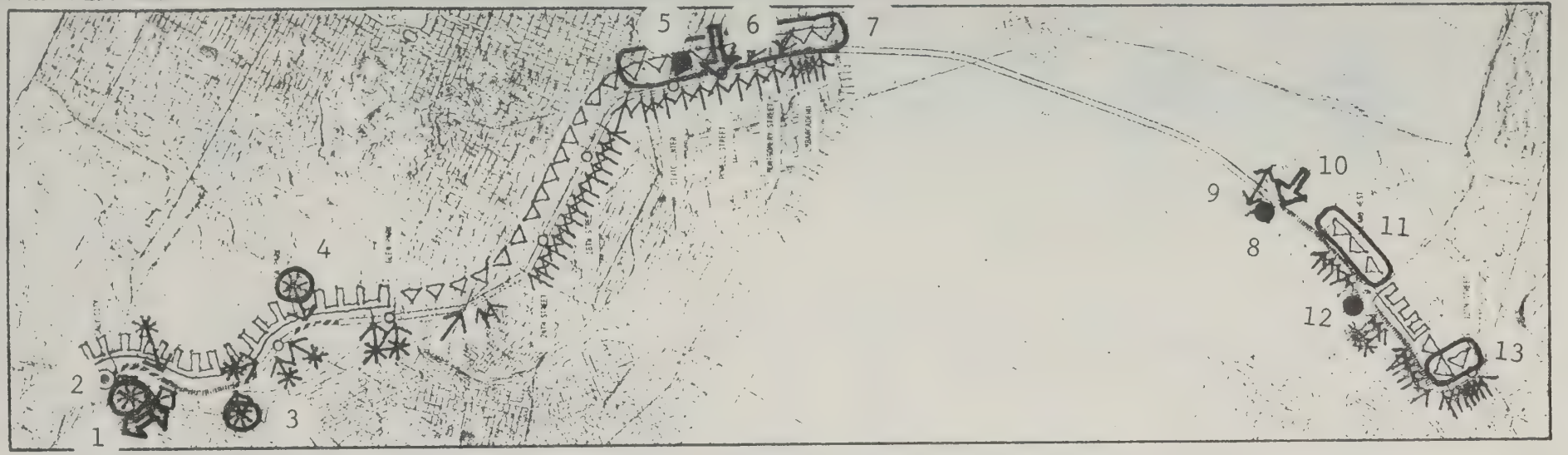
MAY, 1975

0 1 2 4 6 8

APPENDIX A.2 - CIRCULATION IMPROVEMENTS ADJACENT TRANSPORTATION FACILITIES AND BART CONFIGURATION



RICHMOND LINE



LEGEND

17

NORTH

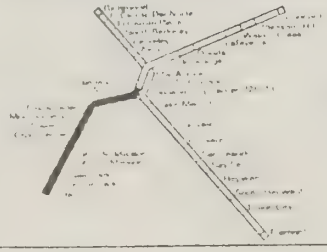
THE ENVIRONMENT PROJECT

BART IMPACT PROGRAM

MAY, 1975

0 1 2 4 6 8

APPENDIX A.2 - CIRCULATION IMPROVEMENTS ADJACENT TRANSPORTATION FACILITIES AND BART CONFIGURATION



DALY CITY LINE

LEGEND

17

NORTH

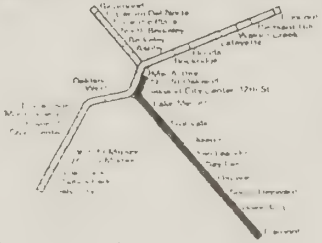
THE ENVIRONMENT PROJECT

BART IMPACT PROGRAM

MAY, 1975

0 1 2 4 6 8

APPENDIX A.2 - CIRCULATION IMPROVEMENTS ADJACENT TRANSPORTATION FACILITIES AND BART CONFIGURATION



FREMONT LINE

A3:

BART-RELATED

CIRCULATION IMPROVEMENTS

REFERS TO APPENDIX A.2	STREETS & PEDESTRIAN PATHS BLOCKED	INITIATED BY	IMPROVEMENTS TO VEHICULAR AND PEDESTRIAN MOVEMENT
1	DALY CITY LINE	BART	San Pedro Ave. improvements
2		BART	Modifications to St. Charles St. pedestrian/vehicular grade separation
3		BART	Extension of Cayuga Playground pedestrian grade separation
4		BART	Extension of Balboa Park pedestrian grade separation
5	Leavenworth St. termination	San Francisco	
6		San Francisco	5th St. extension through Hallidie Plaza to north side of Market
7		San Francisco	Market St. surface improvements
8	Maritime St. termination	Port of Oakland, U.S. Army, U.S. Navy	
9		Port of Oakland, U.S. Army, U.S. Navy	Maritime St. pedestrian grade separation
10		Port of Oakland, U.S. Army, U.S. Navy	Maritime St. realignment
11		Port of Oakland	7th St. widening
12	Center St. discontinued south of 7th St. at Oakland West station	BART	
		Oakland	Surface improvements to Broadway
	FREMONT LINE		
1		Oakland	Surface improvements to Broadway
2		BART	E. 12th St. realignment around Fruitvale station parking lot; widening and median to 19th St.
3		Alameda County/BART	Pedestrian grade separation to Coliseum Complex from Coliseum station
4		San Leandro	Extension of San Leandro Boulevard from Williams St. to Washington Ave.
5		BART	159th St. connection between Foothill and Hesperian Blvds.
6		BART	Pedestrian grade separation between Bayfair station parking areas
7		Bayfair Shopping Center	Vehicular access to Bayfair Shopping Center from 159th St.
8		Bayfair Shopping Center	Pedestrian access from Bayfair Shopping Center to station (in progress)
9		Alameda County	Frontage road between Ashland Ave. and 159th St.
10		Alameda County	Ashland Ave. grade separation
11		BART	Improvements to pedestrian grade separation beneath Highway 238

REFERS TO APPENDIX A.2	STREETS & PEDESTRIAN PATHS BLOCKED	INITIATED BY	IMPROVEMENTS TO VEHICULAR AND PEDESTRIAN MOVEMENT
12		Hayward	"D" Street grade separation
13	Sycamore St. discontinued across WPRR and BART right-of-way	Hayward	
14		Hayward	Sycamore St. pedestrian grade separation
15	Continuous pedestrian access across WPRR right-of-way blocked by BART fences	BART	
16		Hayward	Orchard Ave. grade separation
17	Berry St. discontinued across WPRR and BART right-of-way	Hayward	
18		Hayward	Harder Rd. grade separation
19		Hayward	Whitman Ave. frontage road improvements
20	Sorenson Rd. discontinued across WPRR and BART right-of-way	Hayward	
21	Removal of pedestrian underpass across WPRR right-of-way	Hayward	
22		Hayward	Sorenson Rd. pedestrian grade separation
23		Hayward	Dixon Rd. extension to Tennyson Rd.
24		Hayward	Industrial Parkway grade separation
25		State Division of Highways	WPRR realignment to accomodate future freeway right-of-way (Highway 238)
26		Hayward	Whipple Rd. grade separation
27		Union City	Niles Blvd. grade separation
28		Fremont	Walnut Way connected
	RICHMOND LINE		
1		BART	40th Ave. improvements at MacArthur station
2		Oakland	Widening and median separation of Grove St.
3		Berkeley	Reconstruction of Adeline/Grove intersection
4	Prince St. discontinued between Tremont St. and Grove St.	BART	
5		Berkeley	Ashby Ave. surface improvements at Adeline St.
6		Berkeley	Shattuck Ave. and Adeline St. surface improvements - University Ave. to Grove St.

REFERS TO APPENDIX A.2	STREETS & PEDESTRIAN PATHS BLOCKED	INITIATED BY	IMPROVEMENTS TO VEHICULAR AND PEDESTRIAN MOVEMENT
7	California St. discontinued between Delaware and Hearst	Berkeley	
8	Nielson Ave. discontinued at BART aerial to subway transition	Berkeley	
9	Northside Ave. discontinued at BART aerial to subway transition	Berkeley	
10		BART/Albany	Albany Linear Park
11		BART/El Cerrito	El Cerrito Linear Park
12	Continuous pedestrian access across Santa Fe right-of-way blocked by BART fences	BART	
13		Richmond	37th Ave. grade separation
14		Richmond	Nicholl Park pedestrian grade separation
15		Richmond	23rd. St. grade separation (proposed - funds committed)
16		Richmond	Nevin Ave. pedestrian grade separation through Richmond station
17		Richmond	Barrett St. grade separation
18	Roosevelt Ave. discontinued at BART r-o-w	Richmond	
	Pennsylvania Ave. discontinued at BART r-o-w	Richmond	
		Richmond	Kearny St. grade separation
	CONCORD LINE		
1		BART	40th Ave. improvements at MacArthur station
2		BART	College Ave. improvements at Rockridge station
3		State Division of Highways	Improvements to Camino Pablo Rd. under the freeway and Orinda station
4		State Division of Highways	Grade separated path from north to south side of the freeway at Orinda station
5		State Divsion of Highways	Widening and realignment of Highway 24 from Orinda to Walnut Creek
6		State Division of Highways	Pedestrian grade separation through Lafayette station and freeway
7		State Division of Highways	Deer Hill Rd. extension
8		State Division of Highways	1st. Street extension and grade separation
9		Walnut Creek	Ygnacio Valley Rd. improvements
10		Walnut Creek	Oakland Ave. improvements
11		Walnut Creek	Jones Rd. - frontage road
12		Concord	Bancroft Rd. grade separation
13		BART	Oak Grove school pedestrian grade separation
14		Concord	Oak Grove Rd. grade separation
15		Concord	David Ave. frontage road
16		Concord	Concord linear park

APPENDIX B:

SAFETY AND SECURITY

B: PERSONS INTERVIEWED DURING STUDY

TRANSIT PROPERTY SPOKESMEN

Alameda/Contra Costa County Transit

Harold Fell (Scheduling)
Walter Martin (Accounting Department)
Stan Pearce (Safety Department)
Transit Supervisors: Walt Howe
Mr. Siegler

Municipal Railway

Mr. Ittig (Scheduling)
Frank Bei (Accident Claims and Investigation)

DEPARTMENT OF PUBLIC WORKS/TRAFFIC ENGINEERING SPOKESMEN

Alameda County

Mr. Beckham (County Engineer)

Berkeley

Herman Sinemas (Traffic Engineer)
John Gildea (Assistant Traffic Engineer)

Concord

Rick Mitchell (Traffic Engineer)

Contra Costa County

Leroy Vuchad (Assistant Public Works Director)

Daly City

C. Mobley (Traffic Engineer)

El Cerrito

Joseph Munoz (Assistant Public Works Director)

Fremont

Myron Harmon (Traffic Engineer)

Hayward

Lou Chianese (Assistant Traffic Engineer)
Barry Abbey (Staff)

Lafayette

Ernest Marriner (City Manager)

Oakland

Bob Lee (Traffic Engineer)

Richmond

Dick Danker (Traffic Engineer)

San Leandro

Phil Long (Traffic Engineer)

San Francisco

Norman Bray (Traffic Engineer)
Scott Shoaf (Staff)

Union City

Glen Bowers (Traffic Engineer)

Walnut Creek

Tom Clauson (Traffic Engineer)
Keith Lockhardt (Traffic Engineer)

POLICE OFFICIALS AND SPOKESMEN

Albany

Chief James Simmons

BART

Lt. Ralph Weuie
Sgt. Larry Danner
Officer John McKissick

Berkeley

Capt. Hickman (Head of Administrative Division)
Sgt. Tom Grant (Patrol Supervisor)

Concord

Lt. Al Jordon (Record Bureau Head)
Lt. Collins (2nd Shift Watch Commander)
Sgt. Ambrose (Patrolman)

Daly City

Lt. Austin
Lt. Cully
Officer Ed Jensen (Patrolman)

El Cerrito

Lt. Edmunds (Traffic)
Capt. Reeves
Sgt. Nelson

Fremont

Jim Frank (Director of Planning and Inspection)
Capt. Roger Neuman (Operations Division Commander)

Hayward

Capt. Sterlinski
Capt. George Kelly (Operations Division)

Contra Costa County

Capt. Luntz (Operations Division)
Capt. Burton (Records Division)

Pleasant Hill

Capt. Kenneth Harn (Operations Division)

Oakland

Lt. Haliday
Charles Heldler (Criminal Investigation Division)
Sgt. Mummy (Patrolman)
Sgt. Larry Murphy (Patrolman)
Sgt. Jim Cooper (Patrolman)
Sgt. Hoban (Patrolman)

San Francisco

Capt. Jeremiah Taylor (Operations Supervisor)
Officer Libert (Criminal Statistics)
Officer Bernardini (Patrolman, South Station)
Glen Russell (Patrolman, Ingleside Station)
Officer Derby (Patrolman, Mission Station)

San Leandro

Lt. Mathis
Lt. Fugate
Sgt. Jack Smith (Supervisor in charge of burglary and theft investigation)

Union City

Lt. Ted Barnes

Walnut Creek

Police Chief Burke

REFERENCES

ENVIRONMENT PROJECT PHASE I DOCUMENTATION

- Interpretive Summary*
- Environmental Impacts of BART* Interim Service Findings (1976)
- Acoustic Impacts of BART* Interim Service Findings (1976)
- Impacts of BART on Air Quality* Interim Service Findings (1976)
- Impacts of BART on the Natural Environment* Interim Service Findings (1976)
- Impacts of BART on the Social Environment* Interim Service Findings (1976)
- Impacts of BART on Visual Quality* Interim Service Findings (1976)
- Theory Background for Study of BART's Impacts (1976)
- Pre-BART Data Analysis (1975)
- Community Monitoring (1976)
- BART and Its Environment: Descriptive Data (1976)
- Research Plan* (1975)

STUDY PARTICIPANTS

Authors

Gruen Associates, Inc.
De Leuw, Cather & Company

Other Participants

Bolt Beranek & Newman, Inc.
TRW, Inc.
Curtis Associates
Dr. Frances M. Carp
Dr. Martin Wachs
Dr. Eugene Grigsby

Performing Organization

Metropolitan Transportation Commission

Sponsoring Organization

United States Department of Transportation
United States Department of Housing and Urban Development

* Document is available to the public through the National Technical Information Service (NTIS), Springfield, Virginia 22151. Other documents are MTC internal working papers.